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# **Kennedy/Jenks Consultants**

**Final Report**

**DRAFT**

## **FREE-PHASE PETROLEUM PRODUCT INVESTIGATION**

**Former Griffin Wheel Brass Foundry  
Tacoma, Washington**

Prepared for:  
**AMSTED INDUSTRIES**  
**Chicago, Illinois**

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**FREE-PHASE PETROLEUM PRODUCT INVESTIGATION**

**FINAL REPORT**

**FORMER GRIFFIN WHEEL BRASS FOUNDRY  
TACOMA, WASHINGTON**

**Prepared for:**

**AMSTED INDUSTRIES  
CHICAGO, ILLINOIS**

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## TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION .....	1-1
1.1 INTRODUCTION AND SUMMARY .....	1-1
1.2 BACKGROUND .....	1-2
1.3 SCOPE OF ACTIVITIES .....	1-3
2.0 INVESTIGATIVE METHODS .....	2-1
2.1 MONITORING WELL AND PRODUCT RECOVERY WELL INSTALLATION .....	2-1
2.2 WELL ELEVATION SURVEYING .....	2-3
2.3 FLOATING HYDROCARBON PRODUCT SAMPLING .....	2-3
2.4 SOIL SAMPLING .....	2-3
2.5 WELL DEVELOPMENT AND GROUNDWATER SAMPLING .....	2-4
2.6 MONITORING WELL OBSERVATIONS .....	2-4
3.0 QUALITY ASSURANCE, DATA VALIDATION, AND STATISTICAL ANALYSIS .....	3-1
3.1 FIELD QA/QC PROCEDURES .....	3-1
3.2 LABORATORY QA/QC REVIEW .....	3-2
3.3 DATA VALIDATION .....	3-2
4.0 INVESTIGATIVE FINDINGS .....	4-1
4.1 FIELD OBSERVATIONS AND EVALUATION .....	4-1
4.2 CHEMICAL ANALYSIS OF SOIL SAMPLES .....	4-4
4.2.1 Volatiles .....	4-5
4.2.2 Semivolatiles .....	4-5

## TABLE OF CONTENTS

	<u>Page</u>
4.2.3 Metals .....	4-6
4.2.4 Total Petroleum Hydrocarbons .....	4-6
4.2.5 Discussion .....	4-6
4.3 GROUNDWATER SAMPLING AND ANALYSIS PROGRAM .....	4-7
4.3.1 Volatiles .....	4-8
4.3.2 Pesticides/PCBs .....	4-8
4.3.3 Semivolatiles .....	4-9
4.3.4 Metals .....	4-9
4.3.5 Cyanide .....	4-10
4.3.6 Total Petroleum Hydrocarbons .....	4-10
4.3.7 Total Organic Carbon .....	4-10
4.4 DISCUSSION .....	4-10
4.5 NATURE AND EXTENT OF PETROLEUM HYDROCARBONS IN THE SUBSURFACE .....	4-11
5.0 REVIEW OF ALTERNATIVE REMEDIAL RESPONSES .....	5-1
5.1 MONITORING .....	5-1
5.2 PUMP AND TREAT .....	5-2
5.3 BIOREMEDIATION .....	5-6
5.4 EXCAVATION .....	5-8
5.5 CUTOFF .....	5-10
5.6 STEAM INJECTION AND STEAM EXTRACTION .....	5-12
5.7 REMEDIAL ACTION SELECTION .....	5-13
6.0 SUMMARY AND RECOMMENDED ACTION .....	6-1
6.1 SUMMARY OF FINDINGS .....	6-1
6.2 RECOMMENDED ACTION .....	6-2



## TABLE OF CONTENTS

	<u>Page</u>
7.0 REFERENCES .....	7-1

## APPENDICES

APPENDIX A	SITE MAP
APPENDIX B	PARTIAL PLAN: AMSTED PROPERTY GEOLOGICAL CROSS SECTIONS
APPENDIX C	BORING AND WELL CONSTRUCTION LOGS NMW-8 SIEVE ANALYSIS
APPENDIX D	PRODUCT ANALYTICAL RESULTS
APPENDIX E	SOIL ANALYTICAL RESULTS
APPENDIX F	GROUNDWATER ANALYTICAL RESULTS
APPENDIX G	VALIDATION REPORTS

## LIST OF TABLES

		<u>Follows Page</u>
TABLE 2-1	SURVEY DATA FOR MONITORING AND PRODUCT RECOVERY WELLS .....	2-3
TABLE 4-1	SUMMARY OF ANALYTICAL RESULTS FOR PETROLEUM PRODUCT - FORMER GRIFFIN WHEEL BRASS FOUNDRY .....	4-4
TABLE 4-2	SUMMARY OF ANALYTICAL RESULTS FOR SOIL SAMPLES - FORMER GRIFFIN WHEEL BRASS FOUNDRY .	4-4
TABLE 4-3	SUMMARY OF GROUNDWATER ANALYTICAL RESULTS .	4-7

## 1.0 INTRODUCTION

### 1.1 INTRODUCTION AND SUMMARY

This report presents the results of the subsurface investigation performed at Amsted Industries' Former Brass Foundry (Griffin Wheel Brass Foundry) at South Tacoma Field (STF) to characterize the occurrence of free-phase petroleum product in the vicinity of MW-2. A site location map (Figure 1) is included in Appendix A. The report also presents a review of remedial alternatives and recommendations to address the conditions identified by the investigation. The subsurface investigation and remedial alternatives review were performed pursuant to the requirements of the U.S. Environmental Protection Agency (EPA) Administration Order on Consent No. 1091-05-10-106 (Order on Consent). The investigation and review work presented herein fulfills the requirements of the Order on Consent. The work plan entitled *Well Installation and Monitoring Former Griffin Wheel Brass Foundry - Tacoma, Washington*, February 1992 by Kennedy/Jenks Consultants (Work Plan) presented the objectives and technical approach for conducting this investigation. The principal technical objective was to evaluate the <sup>vertical</sup> lateral extent of free-phase petroleum product present on the water table in the vicinity of the former location of several underground storage tanks (USTs). Field work completed under the Work Plan included installation, monitoring, and sampling of seven resource protection (monitoring) wells. This report presents the data, observations, evaluations, and conclusions based on the field investigation and provides recommendations for the next phase of work associated with the free product floating on the groundwater.

## 1.2 BACKGROUND

As discussed in the *Remedial Investigation/Risk Assessment/Feasibility Study, Former Brass Foundry Area, South Tacoma Swamp* prepared for TIP Management/Amsted Industries by Kennedy/Jenks/Chilton in 1987, elevated concentrations of petroleum hydrocarbons were noted in soil samples collected during boring of MW-2. This well was installed in September 1986 immediately adjacent to the USTs located north of the foundry. Reportedly, these USTs were used to store bunker oil for the foundry operation. There were no detected concentrations of petroleum hydrocarbons or purgeable aromatic compounds in a groundwater sample collected from monitoring well MW-2 in October 1986. Further discussion of the 1986 sampling efforts is presented in Section 2.4 of the Work Plan.

Groundwater monitoring for the STF project was initiated in April 1991. During the first attempt at measuring the water level in MW-2 at the site, a floating (i.e., free phase) layer of petroleum product was found in the well. In addition, the apparent vandalism of MW-4 was discovered.

Upon finding the product and notification of the EPA, the Order on Consent between Amsted Industries (owner of this property) and the EPA was negotiated to encompass the investigation and delineation of the soil and groundwater relative to the presence of the free-phase product.

In response to these findings, two attempts were made to bail product from MW-2, and a preliminary evaluation of the problem was made.

This preliminary work, including the attempts at bailing the well, observation of the product, and laboratory testing, was presented in the *Well Closure and Preliminary Fuel Investigation, Former Griffin Wheel Brass Foundry, Tacoma, Washington*, by Kennedy/Jenks Consultants dated July 1991. Results of this testing indicate the presence of a relatively high-viscosity petroleum product that would make future



recovery operations difficult. In addition, MW-4 was closed in accordance with State of Washington regulatory requirements (WAC-173-160).

Since the subject site is part of the STF Superfund site currently under investigation, the results of work performed for the STF project that are applicable to the subject site have been utilized as much as possible in the development of the Work Plan and will continue to be used to interpret the findings of ongoing investigations.

As described in the Work Plan, the investigation discussed in this report involved the installation of six planned resource protection wells in the vicinity of the former USTs. After these wells were installed, one additional well (NMW-14) was installed based on the field conditions to the south of well NMW-9.

### 1.3 SCOPE OF ACTIVITIES

The investigative work conducted under the Work Plan was developed to characterize the presence and distribution of relatively immiscible petroleum product found in MW-2. This work fulfills the requirements of the investigation and remedial action project described in the Order on Consent (hereinafter "the project"). This work provides substantive data required to complete the project, and is a significant step in characterizing the distribution of hydrocarbons in the subsurface.

*"work" doesn't include removal. Final report will be necessary.*

The scope of work included in the Work Plan included the following generalized tasks:

- Well installation
- Water level monitoring



- Evaluation of product layer response to product recovery
- Soil, groundwater, and product sample collection
- Laboratory analyses (including validation)
- Investigative data evaluation
- Remedial alternatives evaluation
- Report preparation.

This report presents data collected during implementation of the Work Plan and the evaluation of the data with respect to the nature and the extent of hydrocarbons in the subsurface. It also discusses field procedures, field observations, and summarizes and evaluates various potentially applicable technologies for remediation of free-phase petroleum products in the subsurface. This report concludes with a recommended action based on identified site conditions and adjacent property uses.

The majority of this investigative effort focused on characterization of the extent of free-phase product in the subsurface. This report also presents data generated from laboratory testing of groundwater samples collected from wells that do not contain free product. These data are compared with drinking water standards and will be used to help select parameters for future monitoring and data collection.

## 2.0 INVESTIGATIVE METHODS

This section describes the field activities associated with the well installation and monitoring at the former Griffin Wheel Brass Foundry. Field procedures used during the field activities are described in the Standard Operating Guidelines (SOGs), which were provided as Appendix E to the Work Plan.

### 2.1 MONITORING WELL AND PRODUCT RECOVERY WELL INSTALLATION

Six monitoring wells (NMW-8, NMW-9, NMW-10, NMW-11, NMW-12, and NMW-14) and one product recovery well (NMW-13) were installed during this investigation. The numbering system used to designate these wells was based on a continuation of the numbering scheme used during the STF Remedial Investigation (RI). The siting rationale for wells NMW-8 through NMW-13 was described in Section 3.0 of the Work Plan. Monitoring well NMW-14 was installed to provide an additional exploration to characterize the lateral extent of petroleum hydrocarbons in soil and/or groundwater, based on the discovery of petroleum hydrocarbons in soil during the installation of monitoring well NMW-9. The locations of these wells with respect to existing structures and existing monitoring wells (MW-1, MW-2, and MW-3) are shown on the Partial Plan, entitled Subsurface Investigation (Appendix B).

The wells were installed using a hollow-stem auger drill rig. The monitoring well borings were drilled initially with 4.25-inch inner-diameter (I.D.) augers to allow for placement of 2-inch diameter well casing. One well boring (NMW-9) was overdrilled with 6.25-inch I.D. augers to allow for placement of 4-inch diameter well casing. NMW-9 was completed using 4-inch diameter casing and screen as a contingency measure to permit its use in future recovery efforts because oily soil was encountered in the well boring during drilling. The boring for product recovery

well NMW-13 was drilled with 8.25-inch I.D. augers to allow for placement of 6-inch diameter well casing.

Drilling and well installation were conducted in accordance with the requirements of Minimum Standards for Construction and Maintenance of Wells (WAC 173-160) for resource protection wells, and the procedures described in SOG-11 in the Work Plan. Borehole logging was completed using the procedures described in SOG-15. Copies of the boring and well construction logs are in Appendix C.

A sieve analysis was performed on a soil sample collected from the saturated zone in the boring for well NMW-8 to determine the grain-size distribution. This information was used to select the screen slot size and filter pack material in accordance with SOG-16 in the Work Plan. A plot of the sieve analysis is contained in Appendix C.

The NMW-8 saturated zone soil sample was retained and visually compared with samples collected from the saturated zone in the well borings for wells NMW-9, NMW-10, NMW-11, NMW-12, NMW-13, and NMW-14. Based on the field geologist's visual comparisons, the soil textures throughout the screened stratigraphic intervals in each of the other wells were determined to be similar to the texture of the NMW-8 sample, and the same filter pack and screen slot size was used for all of the monitoring wells. The filter pack selection was conservative (i.e., a smaller filter pack size was used than the maximum permissible size allowed according to SOG-16 for the monitoring wells, based on the premise that the purpose of the wells was to obtain groundwater samples with minimal turbidity). A larger filter pack size, still within the maximum limit allowed by SOG-16, was used for the product recovery well. The larger size was considered appropriate to promote the flow of viscous hydrocarbon product into the well for recovery purposes.

both  
NMW-9 &  
NMW-13?

## 2.2 WELL ELEVATION SURVEYING

Elevations of the well casings and adjacent ground surfaces were surveyed using monitoring well MW-2 as an elevation reference point. This well was surveyed during the STF Groundwater Investigation. Horizontal control was obtained by taping distances from previously surveyed points on the ground surface. Locations of the monitoring and product recovery wells in relation to existing structures at the site are shown on the Partial Plan, Subsurface Investigation (Appendix B). Table 2-1 is a list of elevations that were measured during this investigation.

## 2.3 FLOATING HYDROCARBON PRODUCT SAMPLING

Prior to drilling and well installation, a sample of floating product was bailed from monitoring well MW-2 and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (BNAs), pesticides/polychlorinated biphenyls (PCBs), and metals using EPA's Contract Laboratory Program (CLP) methods. In addition, the product sample was analyzed for polynuclear aromatic hydrocarbons (PAHs) using EPA Method 8310. The results of the laboratory analyses are presented in Appendix D.

## 2.4 SOIL SAMPLING

Soil samples were typically collected from the well borings at 5-foot intervals. Additional soil samples were collected from the unsaturated zone just above the water table. Depths at which soil samples were collected are shown on the boring and well construction logs (Appendix C).

Soil samples were collected using a drive sampler fitted with 2.5-inch outside diameter (O.D) stainless steel liners. A total of three soil samples were selected for laboratory analysis using the selection criteria described in Section 3.0 of the Work



**TABLE 2-1**

**SURVEY DATA FOR  
MONITORING AND PRODUCT RECOVERY WELLS**

Well No.	Location No.	Ground Surface Elevation (ft MSL <sup>(a)</sup> )	Casing Elevation (ft MSL <sup>(a)</sup> ) <sup>(b)</sup>
NMW-8	1789	250.7	252.66
NMW-9	1790	250.8	253.57
NMW-10	1791	250.9	253.18
NMW-11	1792	249.7	251.85
NMW-12	1793	250.2	252.27
NMW-13	1794	250.0	252.14
NMW-14	1795	247.1	249.22

Notes:

- (a) Feet above mean sea level, City of Tacoma NGVD 29 vertical datum.
- (b) Elevation of top of PVC casing, City of Tacoma NGVD 29 vertical datum.

Plan. Samples were analyzed for VOCs, semivolatiles, and metals using CLP methods. At EPA's request, samples were later analyzed for total petroleum hydrocarbons (TPH) by Method WTPH-418.1 (Washington State Method). An additional soil sample from the boring for NMW-14 was also selected for laboratory analysis due to the apparent presence of organic vapors. This sample was analyzed for volatile and semivolatile compounds also using CLP methods. Analytical results for these soil samples are presented in Appendix E. The remaining samples were archived.

## 2.5 WELL DEVELOPMENT AND GROUNDWATER SAMPLING

Wells were developed using the procedures described in SOG-17 of the Work Plan. Following development and a waiting period, groundwater samples were collected from new monitoring wells NMW-8, NMW-9, NMW-10, NMW-11, NMW-12 and NMW-14 and from existing monitoring wells MW-1 and MW-3 on 4 and 5 May 1992. The new monitoring wells were purged and sampled using a 2-inch Teflon and stainless steel submersible pump. Existing monitoring wells were purged and sampled using the dedicated pumps that are installed in those wells. Groundwater purging and sampling were performed using the procedures described in SOG-12 of the Work Plan. Groundwater samples were analyzed for the same parameters that were specified for groundwater samples collected during the STF RI. In addition, groundwater samples were analyzed for TPH. Groundwater analytical results are contained in Appendix F.

*why not NMW-13?*

## 2.6 MONITORING WELL OBSERVATIONS

The product recovery well (NMW-13) was monitored over a 4-week period following its installation. The purpose of monitoring was to observe and measure, if possible, changes in the thickness of the floating hydrocarbon product with time.

*— NMW-13?*

*product detected?*

The new monitoring wells (NMW-8, NMW-9, NMW-10, NMW-11, NMW-12, and NMW-14) were not monitored because floating product was not present.

The product recovery well was monitored on 10 separate days. Monitoring consisted of placing a bailer in the well at the groundwater surface and extracting water and product, if present. The well was also pumped on two separate days. Observations were then recorded. These observations are described in Section 4.1.

### 3.0 QUALITY ASSURANCE, DATA VALIDATION, AND STATISTICAL ANALYSES

#### 3.1 FIELD QA/QC PROCEDURES

During field operations, quality control (QC) samples were collected to monitor both field and laboratory operations. The purpose of this monitoring was to facilitate the evaluation of the precision and the accuracy of analytical data throughout the project. QC samples consisted of a field duplicate and blank samples (i.e., a rinsate and trip blank) collected during groundwater sampling.

One field duplicate groundwater sample was collected from one well during the May sampling event. The field duplicate was assigned a unique sample number, and was submitted and analyzed as a separate sample. This sample was not identified to the analytical laboratory as a duplicate. The duplicate sample was collected in accordance with SOG-14 of the Work Plan.

One blank sample was submitted for laboratory analysis for each day spent in the field sampling groundwater. A rinsate blank sample was collected when decontamination of sampling equipment was performed (e.g., when non-dedicated bailers and/or pumps were used for sampling). One trip blank sample was submitted for each 20 groundwater samples (i.e., one trip blank was submitted for the sampling event performed during this investigation).

A rinsate blank was collected to monitor the effectiveness of decontamination procedures and to identify the potential for cross-contamination between sampling locations. The rinsate blank was collected by rinsing decontaminated sampling equipment with deionized water and placing the collected rinsate water in appropriate containers with required preservatives. The rinsate blank was analyzed for the same constituents as groundwater samples.



The trip blank was carried during sampling and submitted for analysis to monitor for possible volatile organic contamination caused by diffusion of organic contaminants through the polytetrafluoroethylene-faced silicone rubber septum of the sample vials during transport to and from the laboratory, as well as to monitor the quality of the laboratory water. The trip blank was prepared by the laboratory by filling a volatile organic analysis (VOA) vial with deionized water and shipping the blank with the sample containers. The trip blank was analyzed for VOCs only.

Analytical results for QC samples are presented in Appendix F. These results were evaluated by EcoChem, Inc. (EcoChem) as part of the data validation requirements (Section 3.3). Discussions of this evaluation are presented in the Groundwater Data Validation Report (Appendix G).

### **3.2 LABORATORY QA/QC REVIEW**

Analytical methods outlined in EPA's CLP Statements of Work (EPA 1988a; 1990a,b) were used to measure organic and inorganic constituents. EPA's CLP methods specify QC procedures that the laboratory is expected to meet or exceed. These procedures include analysis frequency and QC limits for laboratory method blanks, spiked samples, duplicates, and laboratory control samples. Analytical results and QC criteria were evaluated by the laboratory as part of their data reduction and documentation procedures, and in accordance with those procedures outlined in the STF Quality Assurance Project Plan (QAPjP) (Kennedy/Jenks/Chilton 1991a). Laboratory qualifiers were assigned to data during this review as outlined in the CLP Statements of Work (EPA 1988a; 1990a,b).

### **3.3 DATA VALIDATION**

Data validation of analytical results was performed to evaluate procedural compliance with QA objectives as outlined in the STF QAPjP

(Kennedy/Jenks/Chilton 1991a) and to assess the laboratory's performance in meeting the QC specifications for detection limits, accuracy, precision, and completeness as outlined in the CLP Statements of Work (EPA 1988a; 1990a,b). Data validation was performed by EcoChem.

Data validation was based on the criteria described in the functional guidelines for evaluating inorganic and organic analyses (EPA 1988b,c,d). Data that did not meet required criteria were flagged with validation qualifiers. A 100-percent data validation was completed for all groundwater and product analytical results. In addition, three of four soil analytical results were also validated. The data validation reports are presented in Appendix G.

## 4.0 INVESTIGATIVE FINDINGS

### 4.1 FIELD OBSERVATIONS AND EVALUATION

Observations were made during installation of soil borings, well development, and through periodic pumping and bailing. The observations provide a partial understanding or conceptual view of the subsurface conditions in the area of the borings. The information gathered was considered when remediation alternatives described in Section 5.0 were evaluated and was used to arrive at the conclusions presented in Section 6.0.

Boring and well construction logs for the new wells are included in Appendix C. Information from these new well logs and the well log from MW-2 was used to construct the geologic cross-sections included in Appendix B. Information from other borings installed as part of the STF project were also used to construct the geological sections. (The lithology below the bottom of the new wells was interpreted from information obtained from deeper borings.)

Borings NMW-9, NMW-13, and MW-2 contain petroleum-contaminated soil. Soil particles from the sample collected from 15.0 to 17.0 feet below ground surface (BGS) in NMW-13 were coated with a visible petroleum sheen. Heavy staining was found in the NMW-13 soil samples collected from 20.0 to 22.0 feet BGS and 25.0 to 27.0 feet BGS. Samples collected from the boring for NMW-9 were stained below 23.0 feet BGS. The well log for monitoring well MW-2 indicates "moderate hydrocarbon odor and visible contamination" from the sample collected at 23.5 feet BGS. Visible petroleum contamination was not observed below the zone of water table fluctuation in any boring, and was not observed in any boring above the zone of water table fluctuation except NMW-13.

how was this determined?

Some petroleum-contaminated soil was removed at the time the USTs were removed, indicating a release occurred at or near the tanks. However, the exact point of the release or type of release (i.e., surface spill, tank overflow, pipeline leak, or tank leak) was not identified. Petroleum-contaminated soils were found nearest to the ground surface at NMW-13, suggesting that the release probably occurred close to well NMW-13.

The horizontal limits of the petroleum-contaminated soil for the zone surrounding the point of release were generally defined. Cross Sections A-A and B-B (Appendix B) show estimated horizontal and vertical extent of product in the soil. The Partial Plan, Subsurface Investigation (Appendix B) shows the estimated horizontal extent of product in the soil. These drawings were constructed by considering both the position of the product and its vertical thickness to project the position of the boundary of the contaminated zone. The monitoring wells surrounding the former tank location (i.e., NMW-8, NMW-10, NMW-11, NMW-12, NMW-14, and MW-2) do not currently contain observable evidence of product in soil or groundwater.

Well NMW-13 was regularly pumped and/or bailed throughout the month of April 1992 (i.e., 2, 3, 4, 6, 8, 11, 14, 18, 22, and 30 April 1992). Well NMW-9 was also bailed periodically. However, no floating product was observed, and observations were discontinued. A pneumatic ejector pump, operating at approximately 0.5 gallons per minute (gpm), was used for pumping well NMW-13. The pump was raised and lowered within the water column inside the well. The pump was positioned at both the bottom of the well and at just below the surface of the fluid column in the well. This provided the ability to pump both water and product from the well. The other monitoring wells also were bailed to monitor for the possible presence of product.

The flow of free-floating product into NMW-13 occurs at an extremely slow rate. No product was ever recovered inside the bailer when the well was bailed, although the surface of the water table inside the well contained some globules of free-



floating product. This material was removed by pumping. It was skimmed from the liquid surface by positioning the pump intake at the liquid surface. No product was recovered by pumping from any other level inside the well. The amount of product collected was estimated to be less than 100 ml and was observed floating on the liquid surface inside the drums used to collect the pump discharge water.

The globules of floating product were not present in sufficient quantity to cover the water surface in well NMW-13 and were deflected away from the bailer when attempts were made to remove them by bailing. On the final bailing attempt, paper towels were affixed to the bailer and used as a sorbent medium. This increased the amount of product collected by bailing. This exercise demonstrates that the amount of product potentially recoverable by pumping or bailing techniques is probably negligible.

Product thickness observed in MW-2 during the two bailing and sampling events was estimated to be a maximum of several inches in thickness. The initial report by field personnel who discovered the product in MW-2 stated that the product thickness might be several feet. Current findings support the observation that, although water table fluctuations over the 6-year period since well MW-2 was installed probably coated the inside surface of the well screen with the floating product, the actual floating product thickness in the well is only a maximum of several inches.

Product thickness measurements from a monitoring well are often considerably thicker than the actual thickness of the floating product in the formation surrounding the well. This phenomena is caused by a capillary rise of floating product above the water table. The product then flows into the well, and the force of the product above the water displaces the water with product. Equipment manufacturers often claim that their product skimming systems can recover free product floating on the water table down to one-quarter inch or less. Our experience with a variety of product skimming systems is that effective operation

of these systems in this range only occurs under ideal conditions. Several conditions for ideal operation, which are not met at this property, are as follows:

- Pumping from shallow depths so that product thickness and the water table surface can be easily observed and the system finely adjusted
- Fluctuation in the water table elevation is very small so that the vertical position of the equipment, once the system is adjusted, does not have to be frequently changed.

#### 4.2 CHEMICAL ANALYSIS OF SOIL SAMPLES

Soil samples were collected from several of the borings at depths where hydrocarbons were visually evident in order to assess whether potentially hazardous substances were contained in the hydrocarbon material.

Previous sampling of the petroleum product within MW-2 showed a variety of semivolatile compounds (primarily PAHs), as well as low concentrations of metals and volatile organics. For reference, these results are presented in Table 4-1.

Originally, three soil samples were to be analyzed for the constituents found in the hydrocarbon sample (i.e., semivolatiles, VOCs, and metals). Soil samples were collected during the installation of NMW-10, NMW-11, and NMW-13 at depths ranging from 23 to 29.5 feet BGS. An additional soil sample was collected during the installation of NMW-14 (39 feet) due to the presence of odors. This sample was analyzed for volatile and semivolatile compounds only.

The analytical results for the soil samples are summarized in Table 4-2 along with appropriate regulatory criteria. Complete analytical results are provided in Appendix E.

TABLE 4-1

**SUMMARY OF ANALYTICAL RESULTS FOR PETROLEUM PRODUCT<sup>(a,b)</sup>  
FORMER GRIFFIN WHEEL BRASS FOUNDRY**

Analyte	Sample Results ( $\mu\text{g/kg}$ )			Duplicate Results ( $\mu\text{g/kg}$ )	
<b>VOLATILES</b>					
Methylene Chloride	B	2,000	R <sup>(c)</sup>	B	790 UJ <sup>(d)</sup>
Acetone	J <sup>(e)</sup> B	300	R	JB	340 UJ
Benzene	U <sup>(f)</sup>	50	R		60
Ethyl Benzene		810	R		1,800
Xylenes		420	R		920
<b>PESTICIDES/PCBs</b>		ND <sup>(g)</sup>			ND

Analyte	Sample Results (mg/kg)	Duplicate Results (mg/kg)
<b>METALS<sup>(h)</sup></b>		
Copper	6.5	6.0
Nickel	17.8	16.5
Vanadium	19.2	22.3

Analyte	BNA and PAH (CLP Methods)		PAH (Method 8310)	
	Sample Results ( $\mu\text{g/kg}$ )	Duplicate Results ( $\mu\text{g/kg}$ )	Sample Results ( $\mu\text{g/kg}$ )	Duplicate Results ( $\mu\text{g/kg}$ )
<b>SEMIVOLATILES</b>				
2-Methylnaphthalene	290,000 J4 <sup>(i)</sup>	380,000		
Carbazole	32,000 J4	U 20,000		
Naphthalene	83,000 J4	110,000	U 240,000	U 240,000
Acenaphthene	44,000 J4	U 20,000	U 240,000	U 240,000
Fluorene	110,000 J4	140,000	66,000	69,000
Phenanthrene	200,000 J4	200,000	120,000	120,000
Fluoranthene	32,000 J4	39,000	240,000	330,000
Pyrene	78,000 J4	82,000	35,000	35,000
Chrysene	77,000 J4	62,000	U 24,000	U 24,000

- (a) Only analytical results for compounds that were detected are provided in this table.
- (b) Results are reported on a wet-weight basis.
- (c) B is a laboratory qualifier that is used when the analyte is found in the associated blank as well as in the sample. R is a data validation qualifier that indicates the data are unusable. The analyte was analyzed for, but the presence or absence of the analyte has not been verified.
- (d) UJ is a data validation qualifier that indicates the analyte was analyzed for and was present above the level of associated value.
- (e) J is a laboratory qualifier that indicates an estimated value.
- (f) U is a laboratory qualifier that indicates the compound was analyzed for, but not detected.
- (g) ND = Not detected.
- (h) Only compounds detected above the contract required detection limit (CRDL) are presented.
- (i) J4 is a data validation qualifier that indicates the analyte was analyzed and was positively identified, but the associated value may not be consistent with the amount actually present in the sample.

TABLE 4-2

**SUMMARY OF ANALYTICAL RESULTS FOR SOIL SAMPLES<sup>(a,b)</sup>**  
**FORMER GRIFFIN WHEEL BRASS FOUNDRY**

Analyte	Boring No.				Regulatory Criteria		
	NMW-9 (Sample Depth 23 ft.)	NMW-10 (Sample Depth 27 ft.)	NMW-13 (Sample Depth 29.5 ft.)	NMW-14 <sup>(c)</sup> (Sample Depth 39 ft.)	MTCA Method A <sup>(d)</sup>	EPA Screening Level <sup>(e)</sup>	Site Background Max. <sup>(f)</sup>
<b>VOLATILES (µg/Kg)</b>							
Methylene Chloride	ND <sup>(g)</sup>	ND	ND	JB <sup>(h)</sup> 9.0	500	90,000	--
Acetone	ND	ND	ND	B 26.0	NA <sup>(i)</sup>	30,000,000	ND
Toluene	J 6.0	ND	ND	ND	40,000	50,000,000	ND
Ethyl Benzene	74	ND	ND	ND	20,000	30,000,000	ND
Xylenes	173	ND	ND	ND	20,000	500,000,000	ND

Analyte	NMW-9	NMW-10	NMW-13	NMW-14	Regulatory Criteria		
					MTCA Method A <sup>(d)</sup>	EPA Screening Level <sup>(e)</sup>	Site Background Max. <sup>(f)</sup>
<b>SEMIVOLATILES (µg/Kg)</b>							
Naphthalene	9,300	ND	J 1,600	ND	NA	1,000,000	ND
2-Methylnaphthalene	22,000	ND	3,800	ND	NA	1,000,000	ND
Acenaphthene	J 2,400	ND	ND	ND	NA	20,000,000	ND
Dibenzofuran	J 790	ND	J 160	ND	NA	300,000	ND
Fluorene	3,800	ND	J 840	ND	NA	10,000,000	ND
Phenanthrene	5,100	ND	J 1,300	ND	NA	1,000,000	91
Anthracene	J 930	ND	J 140	ND	NA	80,000,000	14
Di-n-butylphthalate	ND	ND	ND	B 1,000	NA	30,000,000	110
Fluoranthene	J 310	ND	J 160	ND	NA	10,000,000	200
Pyrene	J 1,300	ND	J 370	ND	NA	8,000,000	220
Butylbenzylphthalate	ND	ND	ND	J 48	NA	50,000,000	ND
Chrysene	J 1,100	ND	J 330	ND	1,000	60	130
Bis(2-Ethylhexyl)phthalate	JB 1,400	ND	ND	J 60	NA	50,000	280
Benzo(k)fluoranthene	ND	ND	J 160	ND	1,000	60	49

TABLE 4-2

**SUMMARY OF ANALYTICAL RESULTS FOR SOIL SAMPLES<sup>(a,b)</sup>**  
**FORMER GRIFFIN WHEEL BRASS FOUNDRY**

Analyte	NMW-9	NMW-10	NMW-13	Regulatory Criteria		
				MTCA Method A <sup>(d)</sup>	EPA Screening Level <sup>(e)</sup>	Site Background Max. <sup>(f)</sup>
<b>TOTAL PETROLEUM HYDROCARBONS (mg/Kg)</b>	5,300	ND	1,800	200	NA	NA
<b>METALS (mg/Kg)<sup>(i)</sup></b>						
Aluminum	9,640	10,400	9,740	NA	(k)	21,900
Arsenic	2.5 J4	<CRDL	<CRDL	20	0.4	12
Barium	<CRDL	<CRDL	57.7	NA	20,000	161
Calcium	4,320	4,460	3,770	NA	(l)	4,400
Chromium (total)	21.3	23.5	20.8	100	(k)	30
Copper	13.3	12.3	20.9	NA	20,000	34
Iron	14,900	15,700	15,000	NA	(l)	16,700
Lead	1.2 J4	1.1 J4	3.0 J4	250	500	155
Magnesium	5,020	5,430	5,320	NA	(l)	4,690
Manganese	261	282	237	NA	30,000	634
Nickel	30.6	31.2	30.3	NA	5,000	37
Vanadium	34.4	36.7	30.6	NA	2,000	35
Zinc	30.8	31.6	33.2	NA	50,000	135

- (a) Only analytical results for compounds that were detected are provided in this table.  
 (b) Results are reported on a dry-weight basis.  
 (c) Sample not validated.  
 (d) MTCA Method A Cleanup Level (WAC 173-340-704).  
 (e) Risk based screening level at a carcinogenic risk of  $10^{-6}$  or hazard index of 1.0. Lowest concentration applicable is reported (EPA 1991).  
 (f) Maximum detected background concentration from STF Soil Investigation (Kennedy/Jenks Consultants 1991).  
 (g) ND = Not detected.  
 (h) B is a laboratory qualifier that is used when the analyte is found in the associated blank as well as in the sample. J is a laboratory qualifier that indicates an estimated value.  
 (i) NA = Not available.  
 (j) Only compounds detected above the CRDL are presented.  
 (k) No criteria available, but below maximum background.  
 (l) Below acceptable daily intake for essential nutrients (EPA 1992).



A discussion of the sampling results is provided below for each class of chemical.

#### 4.2.1 Volatiles

One soil sample (at NMW-9) contained constituents typical of lighter hydrocarbon products, including toluene, ethyl benzene, and xylene. Concentrations of these contaminants were low and well below cleanup levels under MTCA Method A or EPA risk based screening levels (EPA 1991). Methylene chloride and acetone were detected in one sample (NMW-14); however, these compounds were also detected in laboratory blanks.

#### 4.2.2 Semivolatiles

A variety of semivolatile compounds, primarily PAHs, were detected in two of the soil samples (NMW-9 and NMW-13). The sum of the detected concentrations of carcinogenic PAHs were in excess of MTCA Method A cleanup levels and EPA residential screening levels at  $10^{-6}$  risk for only one of the samples (NMW-9). However, detected concentrations were below MTCA Method A cleanup levels for industrial land uses (20 ppm) and below EPA screening levels under an industrial exposure scenario. Non-carcinogenic PAH concentrations were all well below EPA screening levels at a hazard index of 1.0.

Several phthalate compounds were detected in one soil sample (NMW-14). These concentrations were below EPA screening levels for  $10^{-6}$  carcinogenic risk and a hazard index of 1.0 for non-carcinogenic risks.

#### 4.2.3 Metals

Metals concentrations detected in the three soils samples were consistent with or below area background (as established by the STF RI) in all cases. All detected concentrations were below MTCA Method A cleanup levels; EPA screening levels for non-carcinogenic, acceptable daily intakes; or maximum background concentrations. Arsenic was detected above the EPA screening level for carcinogenic effects risk of  $10^{-6}$ ; however, the maximum detected concentration was below MTCA Method A cleanup levels and the maximum background concentration.

#### 4.2.4 Total Petroleum Hydrocarbons

TPH concentrations in soil samples for NMW-9 and NMW-13 were 5,300 and 1,800 mg/kg, respectively. Both samples exceeded the MTCA cleanup level of 200 mg/kg. TPH was not detected in the soil sample from NMW-10.

#### 4.2.5 Discussion

Concentrations of chemicals in soil samples appear representative of background concentrations detected at the STF site except for PAHs and TPH. The PAHs appear to be a component of the hydrocarbon product with concentrations of PAHs increasing with increasing TPH concentrations. TPH and PAH concentrations exceeded MTCA and EPA risk-based screening levels in two of the four samples that were analyzed. However, due to the depth at which these samples were collected, it appears that the potential for exposure (via ingestion) to these compounds is minimal. Detected concentrations of semivolatiles were below MTCA Method A cleanup levels for industrial properties and non-carcinogenic PAH concentrations were all well below EPA screening levels. In the past 100 years,

this property has always been used for industrial purposes and is currently surrounded by industrial/commercial land uses.

*This does not mean it will always be used for industrial purposes*

#### 4.3 GROUNDWATER SAMPLING AND ANALYSIS PROGRAM

In order to assess the potential for migration in groundwater of petroleum hydrocarbon constituents away from the identified floating product zone and contaminated vadose zone, groundwater samples were collected from monitoring wells that did not contain visible hydrocarbon contamination and were chemically analyzed. Groundwater from existing monitoring wells (MW-1 and MW-3) along with new monitoring wells installed during the subject investigation (NMW-8 through NMW-12 and NMW-14), were analyzed for organic and inorganic compounds that have been specified for analyses as part of the STF RI. All analyses were performed according to CLP protocol. Additionally, groundwater samples were analyzed for TPH and total organic carbon (TOC), total dissolved solids (TDS), and total suspended solids (TSS). All wells installed during the investigation were sampled with the exception of NMW-13, which exhibited visible heavy fuel oil (HFO) contamination. In addition to groundwater from the monitoring wells, a duplicate sample from NMW-8 was collected as well as a rinsate sample from the bailer between sampling events. Prior to sampling, all wells were purged until pH, temperature, and conductivity stabilized.

A summary of groundwater analytical results is provided in Table 4-3 along with regulatory criteria applicable to each analyte. Complete analytical results are provided in Appendix F. A discussion of the monitoring results is provided below for each class of chemical.

TABLE 4-3

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS<sup>(a)</sup>

Analyte ( $\mu\text{g/L}$ )	Well Number (Location Number)										Regulatory Criteria		
	MW-1 (1773)	MW-3 (1775)	NMW-8 (1789)	Dup 8 (2000)	NMW-9 (1790)	NMW-10 (1791)	NMW-11 (1792)	NMW-12 (1793)	NMW-14 (1795)	Rinsate (3730)	MCL	MCLG	SMCL
<b>VOLATILES</b>													
Chloroform	ND <sup>(b)</sup>	ND	J <sup>(c)</sup> 2.0	J 2.0	ND	J 2.0	J 2.0	J 2.0	ND	ND	100	NA <sup>(d)</sup>	NA
<b>PESTICIDES/PCBs</b>													
beta-BHC	ND	ND	ND	ND	0.13	ND	ND	ND	ND	ND	<sup>(e)</sup>	NA	NA
Endosulfan 1	ND	ND	ND	ND	0.34	ND	ND	ND	ND	ND	<sup>(f)</sup>	NA	NA
Dieldrin	ND	ND	ND	ND	0.10	ND	ND	ND	ND	ND	<sup>(g)</sup>	NA	NA
<b>SEMIVOLATILES</b>													
bis(2-ethylhexyl)phthalate	J 0.6	ND	ND	ND	J 3.0	J 0.8	J 0.6	J 0.7	J 0.7	33	4 <sup>(h)</sup>	NA	NA
<b>METALS<sup>(i)</sup></b>													
Aluminum	ND	<CRDL	891	877	<CRDL	1,091	1,180	832	833	ND	NA	NA	<sup>(j)</sup>
Calcium	14,800	9,290	12,600	13,000	35,200	18,600	30,300	22,900	18,600	ND	NA	NA	NA
Chromium	ND	ND	<CRDL	<CRDL	<CRDL	<CRDL	10.1	10.1	ND	ND	100	100	NA
Copper	ND	ND	3.4 J4 <sup>(k)</sup>	2.5 J4	1.7 J4	2.3 J4	2.1 J4	2.8 J4	28.3	ND	1,300 <sup>(l)</sup>	1,300	1,000
Iron	477 J4	2,470 J4	1,370 J4	1,380 J4	196 J4	1,080 J4	1,460 J4	1,140 J4	1,180 J4	ND	NA	NA	300
Lead	ND	<CRDL	3.9 J4	3.0 J4	<CRDL	<CRDL	3.9 J4	<CRDL	13.9 J4	<CRDL	15 <sup>(m)</sup>	50	NA
Manganese	154	543	74.6	76.1	907	38.6	61.0	31.3	121.0	ND	NA	NA	50
Magnesium	<CRDL	<CRDL	11,400	11,400	27,100	7,530	11,200	9,990	11,700	ND	NA	NA	NA
Nickel	<CRDL	ND	<CRDL	<CRDL	43.2	<CRDL	<CRDL	<CRDL	ND	<CRDL	100	100	NA

TABLE 4-3

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS<sup>(a)</sup>

Analyte (µg/L)	Well Number (Location Number)										Regulatory Criteria		
	MW-1 (1773)	MW-3 (1775)	NMW-8 (1789)	Dup 8 (2000)	NMW-9 (1790)	NMW-10 (1791)	NMW-11 (1792)	NMW-12 (1793)	NMW-14 (1795)	Rinsate (3730)	MCL	MCLG	SMCL
Sodium	6,150	9,860	5,760	5,610	13,800	13,300	29,600	10,100	27,500	<CRDL	NA	NA	NA
Zinc	42.6 J4	<CRDL	63.5 J4	<CRDL	<CRDL	<CRDL	<CRDL	<CRDL	28.7 J4	32.4 J4	NA	NA	5,000
Cyanide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	200 <sup>(h)</sup>	NA	NA
Total Petroleum Hydrocarbons	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<sup>(m)</sup>	NA	NA
Total Organic Carbon	3.4	2.0	1.6	1.47	11.2	1.6	31.6	ND	ND	ND	NA	NA	NA

- (a) Only analytical results for compounds detected in groundwater are provided in the table.
- (b) ND = Not detected.
- (c) J is a laboratory qualifier that indicates an estimated value.
- (d) NA = Not available.
- (e) EPA lowest risk based concentration is 0.05 µg/L at 10<sup>-6</sup> risk.
- (f) EPA lowest risk based concentration is 2 µg/L at Hazard Index of 1.0.
- (g) EPA lowest risk based concentration is 0.005 µg/L at 10<sup>-6</sup> risk.
- (h) Proposed.
- (i) Only compounds detected above the contract required detection limit (CRDL) are presented.
- (j) Proposed SMCL is 50 µg/L.
- (k) J4 is a data validation qualifier that indicates the analyte was analyzed and was positively identified, but the associated value may not be consistent with the amount actually present in the environmental sample.
- (l) Action level.
- (m) MTCA Method A Cleanup Level is 1 mg/l.



#### 4.3.1 Volatiles

Chloroform was detected in four of the eight groundwater samples, all at an estimated concentration of 2  $\mu\text{g/L}$ . The presence of chloroform may be the result of a former leaking water line that was recently repaired, located just north of the groundwater monitoring well network. Chloroform concentrations were well below the maximum contaminant level (MCL) under the Safe Drinking Water Act.

*when repaired  
under what  
authority  
now detected*

Several tentatively identified volatile compounds that appear to be constituents of fuel oil were detected at low concentrations [ $< 10$  parts per billion (ppb)] in well NMW-9.

#### 4.3.2 Pesticides/PCBs

Three pesticides (i.e., beta-BHC, endosulfan, and dieldrin) were detected in one of the eight groundwater samples (NMW-9). No MCLs exist for these compounds. Comparison of detected concentrations with EPA risk-based screening concentrations (EPA 1991) show that concentrations for carcinogens (i.e., beta-BHC and dieldrin) are above  $10^{-6}$  risk levels, but below  $10^{-4}$  risk levels. Detected concentrations are below EPA's risk-based screening levels for non-carcinogenic effects at a hazard index of 1. PCBs were not detected in any other groundwater monitoring wells.

Pesticides and PCBs are not typically found in HFO and were not detected in the sample of HFO collected from monitoring well MW-2. The source of pesticides found in the sample collected from monitoring well NMW-9 is unknown, but its presence in groundwater is probably unrelated to the presence of HFO in the subsurface.

#### 4.3.3 Semivolatiles

Bis(2-ethylhexyl)phthalate was the only semivolatile compound (including PAHs) detected in the samples from all groundwater monitoring wells. This compound was detected in six of eight groundwater samples at estimated concentrations all below the proposed MCL.

Numerous tentatively identified compounds were detected at relatively low concentrations (less than 100  $\mu\text{g/L}$  total) in all of the groundwater samples from the monitoring wells onsite. In general, these compounds can be characterized as typical of those contained in the heavy fuel oil mixtures known to be previously used on the property. These hydrocarbons were also detected in the rinsate samples collected during the investigation.

Semivolatiles detected in groundwater samples do not have associated regulatory criteria.

#### 4.3.4 Metals

A variety of metals were detected in the majority of groundwater samples collected onsite. Aluminum, calcium, chromium, copper, iron, lead, manganese, magnesium, nickel, sodium, and zinc were all detected in at least one sample above the contract required detection limit (CRDL). The concentrations detected in the groundwater samples were typical of, and fell within, the range detected during investigations being performed as part of the STF RI. None of the detected concentrations exceeded available MCLs. Iron and manganese exceeded secondary maximum contaminant levels (SMCLs) in most of the groundwater monitoring wells. This is similar to what has been observed for other monitoring wells throughout the STF site. No specific trends regarding the distribution of metal are apparent.

#### 4.3.5 Cyanide

Cyanide was not detected in any of the monitoring wells onsite.

#### 4.3.6 Total Petroleum Hydrocarbons

TPH were not detected in any of the groundwater samples collected from the site (at a detection limit of 1 mg/L).

#### 4.3.7 Total Organic Carbon

TOC concentrations were generally low and were typical of TOC measurements in other areas of the STF site.

### 4.4 DISCUSSION

The foregoing results indicate that petroleum hydrocarbons detected in subsurface soil at the Amsted site are not significantly impacting local groundwater. All contaminants detected from groundwater monitoring well samples that appear to originate from the migration of petroleum constituents are present at levels below the MCL. Contaminants that were detected above SMCLs were detected at concentrations typical of groundwater throughout the STF site. Pesticides were detected at one well at concentrations between EPA Region 10 risk-based concentrations at  $10^{-4}$  and  $10^{-6}$  risk levels. This was the only groundwater sample collected throughout the entire STF site that has contained detectable pesticide concentrations.

#### 4.5 NATURE AND EXTENT OF PETROLEUM HYDROCARBONS IN THE SUBSURFACE

Petroleum product found in the subsurface at MW-2 appears to be the result of a release associated with the USTs near this location. One of the possibilities considered before this phase of work started was that the product in the subsurface may have been the result of activities on the adjacent industrial property. Since product-free wells surround the former UST location at the former Griffin Wheel Brass Foundry, and soils above the water table in the vicinity of the former USTs contain product, it is unlikely that there is any other source possible than operations at the former Griffin Wheel Brass Foundry.

This product is similar to commercially available HFO as stated in the Well Closure and Preliminary Fuel Investigation. The standards for composition of HFO have been revised in the past, and the current standard for HFO is listed in the above-mentioned report. Grades 5 and 6 HFO are frequently referred to as Bunker B and Bunker C. The HFO used at the former Griffin Wheel Brass Foundry was called Bunker C. However, the viscosity of the product collected from MW-2 falls between the viscosity Grades 5 and 6 HFO.

The product can generally be described as a very immiscible mixture, the constituents of which exhibit low water solubility. This results in separate liquid phases (i.e., product/water).

The viscosity of the product was measured by Herguth Laboratories in June 1991 from a sample collected from MW-2. The viscosity was reported as 1699 Redwood. Research has shown that viscous residual product in excess of 25 percent of the soil pore volume may be trapped due to forces attributed to interfacial tension between the organic and water phases (Payatakes 1982). This residual saturation is left behind as the product moves down toward the water table.

*and as the water table fluctuates*

The product's relative density at 15°C was 0.9672. Liquids lighter than water tend to spread laterally when they encounter the capillary fringe and the water table. As a result of the water table elevation fluctuations in response to seasonal recharge and the possible influence of local pumping wells, the zone potentially exposed to free product may extend over the entire range of such fluctuations. Such "coating" of the water table fluctuation zone is indicated by conditions observed in wells NMW-9, NW-2, and NMW-13. The distribution of product in this zone may be highly variable, ranging from residual amounts to fully saturated lenses. Much of the product may be redistributed with each cycle of the water table. The soil matrices within the two stratigraphic sequences identified on the boring logs and shown in the geologic cross sections (Figures 2 and 3, Appendix B) are not homogeneous. Therefore, the geometric distribution of the contaminant zone is probably much more complex than presented in our geologic cross sections. The concentration of HFO within the area of contamination shown on the figures in Appendix B probably range from near saturated soil at the water table in a small area below the point of release to undetectable at the estimated boundary of the HFO-contaminated soils.

A petroleum product sample was collected in January 1992 from monitoring well MW-2. The petroleum product sample was analyzed for volatiles, metals, pesticides/PCBs, semivolatiles, and PAHs using MSW-846 and the CLP methods as presented in the Work Plan. The analytical results are presented in Appendix D and summarized in Table 4-1. Only analytical results for compounds that were detected are provided in this table.

Four soil samples were collected from borings for wells NMW-9, NMW-10, NMW-13, and NMW-14. These samples were from depths of 23, 27, 29.5, and 39.0 feet BGS, respectively. The samples from borings NMW-9, NMW-10, and NMW-13 were analyzed for the following compounds:

- VOCs



- BNAs
- TPH
- Metals.

The sample from NMW-14 was analyzed for the following compounds:

- VOCs
- BNAs.

The CLP methods described in the Work Plan were again followed. The analytical results are presented in Appendix E and are summarized in Table 4-2. Only analytical results for compounds that were detected are shown in the table.

## 5.0 REVIEW OF ALTERNATIVE REMEDIAL RESPONSES

Six alternatives were selected and screened to evaluate their potential for implementation as response actions to clean up, contain, or monitor HFO in the subsurface. This section describes the alternatives and presents some considerations with respect to their implementation and effectiveness that can be used to judge their overall potential benefits.

The screening for potential cleanup alternatives included evaluation of technical effectiveness, ability to be implemented, and cost. Primary emphasis is given to effectiveness and the ability to be implemented.

The decision to investigate further is based on two factors:

- Our level of knowledge and experience with the technology
- Site conditions that preclude the use of the technology.

### 5.1 MONITORING

Description: Periodic groundwater monitoring at wells surrounding the hydrocarbon product zone would be used to detect floating product and dissolved constituent migration at the Amsted property boundary. Periodic measurements would be made to determine the presence or absence of floating product in wells MW-2, NMW-9, and NMW-13. Verification that dissolved constituents are not migrating from the Amsted property and contaminating the aquifer would be made by periodic sampling and laboratory analysis of groundwater samples from wells surrounding the former UST location. ?

Technical Effectiveness: Periodic monitoring for the presence of HFO floating on the groundwater would provide a means of monitoring whether appreciable HFO quantities are being released from the soil. Collection and analysis of groundwater samples from wells surrounding the former UST location would provide a reasonable early warning mechanism to detect dissolved HFO constituents which indicate increased solubilization and/or movement of such compounds and can trigger a response action.

Technical Ability to be Implemented: Monitoring and testing can be easily implemented.

Cost: Low

Investigate Further: Yes.

Justification: Based on the available groundwater monitoring data, the area affected by this product release is isolated, and beneficial uses of groundwater do not appear to be threatened.

## 5.2 PUMP AND TREAT

Description: One or more recovery wells installed through the floating product zone would be used to remove product from the subsurface. Two wells that could be used for recovery were constructed as part of the investigation of product occurrence. The designs used for these wells were chosen to facilitate their use for the collection of HFO. Pumping of either HFO only, or water and HFO, would be initiated. Water/HFO separation would be achieved in aboveground vessels. Water would be treated and discharged to the sanitary sewer or reinjected into the ground. HFO would be collected for offsite disposal. [Displacement of contaminants from the soil pore space by steam injection may be combined with pumping (Section 5.6 - Steam Injection and Steam Extraction)].

Technical Effectiveness: Various pumping systems and treatment technologies that involve using wells to remove the HFO from the subsurface were originally regarded as feasible for the former UST location at the Amsted property. NMW-13, the 6-inch diameter recovery well, was installed and then periodically pumped or bailed and observed to evaluate the feasibility of this technology. The recharge rate of product into a well after product removal and the thickness of the floating product in the well after nearly steady-state conditions are reached on the recharge cycle, are indicators of how successful the use of a particular well will be for product recovery. Over a month after initially attempting to bail product from monitoring well NMW-13, a recoverable quantity of product still had not collected inside the well. It is apparent from these findings that the use of a recovery system that pumps water and HFO, or HFO only, at low rates is not feasible at this site.

Creating a cone of depression in the water table to induce product to flow toward the recovery well is not practical. The HFO is extremely viscous and would only be induced to move (at an effective rate) in response to a very steep hydraulic gradient. Given the hydraulic conductivity of the sediments comprising the uppermost saturated zone beneath the product layer, the groundwater pumping rate that would be required to induce a steep cone of depression sufficiently steep to induce product flow to the recovery well would be excessive. This conclusion was reached after calculating HFO flow velocity, using data from pumping tests conducted in December 1991, along with the laboratory data from the sample of HFO collected from monitoring well MW-2 in May 1991. Two pumping tests were conducted during the STF project on wells NMW-3 and NMW-4. The pumping tests were run for 50 and 48 hours each. The pumping rate for both tests was 60 gpm. Drawdown measurements for the pumping wells and the observation wells were recorded. The measurements selected for use in the theoretical product recovery calculation were from the end of the pumping test, when drawdown was greatest. Assuming a constant slope of the water table surface between the pumping wells and the observation well, a hydraulic gradient of 0.151 was created during the first test, and a hydraulic gradient of 0.1755 was created during the second test. Equations derived from Darcy's Law were used in the theoretical product recovery

calculation, and the hydraulic gradients given above were used to calculate the product movement rate that would be induced by groundwater pumping at these rates. The kinematic viscosity reported in the laboratory analysis of the HFO sample collected from MW-2 was used in the equation. Factors for hydraulic conductivity and porosity were selected based on the known soil types and inserted into the calculation. The results of this calculation indicate that with the gradient created by pumping at a rate of 60 gpm, HFO will move about 24 feet per year. At a pumping rate of 60 gpm, over a one-year period, the volume of water pumped would be approximately 31.5 million gallons.

The type of estimate presented above is imprecise because the assumptions made oversimplify the actual conditions in the subsurface. However, this estimate shows that creating a cone of depression adequate to induce HFO to flow is not a practical product recovery method. In addition, creating a deep cone of depression may permit product to be "smeared" onto sediments deeper in the saturated zone. Such smearing can decrease the volume of recoverable product and potentially adversely affect groundwater quality.

Technical Ability to Implement: Two logistical problems that would be encountered in implementation of this technology are discussed below.

The first problem is disposing of water separated from the HFO or water pumped to create a cone of depression.

Options generally considered for water disposal are:

- Discharge to a sanitary sewer
- Reinjection
- Collection, offsite transportation, and disposal



- Discharge to surface water under a National Pollutant Discharge Elimination System (NPDES) permit.

All four options have been successfully used at other sites. Disposal in a sanitary sewer initially appears best because of the relatively short distance from the wells to the sanitary sewer on the west side of the property. Reinjection or discharge to surface water, although appearing technically feasible, may require extensive monitoring and obtaining permits may be difficult. Transportation and disposal costs for offsite disposal would have a much higher unit cost than the other two methods.

The second problem is that electrical power is not available on the property and will require reinstallation. Electrical power lines that in the past provided power to the foundry were removed or are down. Electrical power is provided to adjacent businesses, and the old poles may be reused to reestablish power from lines that serve the adjacent businesses.

Cost: Moderate to high.

Investigate Further: No.

Justification: The thin layer of product in the vicinity of MW-2 is not amenable to removal by automated skimming (low-rate pumping) systems. These systems will not draw HFO into the wells. Anticipated groundwater pumping rates required to produce adequate drawdown to induce product flow to recovery wells are high. Large volumes of water would be removed from the groundwater system and would not likely be replaced. The potential risks to human health and the environment posed by the type and quantity of floating hydrocarbon product on the water table do not justify removing large quantities of water to effect minimal product recovery.

### 5.3 BIOREMEDIATION

Description: Bioremediation refers to the bio-oxidation or other biotransformation of organic matter by microorganisms (EPA 1988e). Bioremediation involves introducing bacteria or relying on native bacteria to decompose the hydrocarbon product. The rate at which the bacteria decompose the product is dependent on the availability of oxygen and nutrients. Soil bioremediation can occur aboveground as well as in situ, although aboveground treatment is the more common treatment method (Kaufman 1989). In the aboveground method, soil is placed on a pad in lifts of 1 to 3 feet. A water delivery system typically is used to moisten the soil, and microorganisms and/or nutrients are added, if necessary. The soil is tilled regularly to mix the microorganisms, nutrients, and water to promote efficient contaminant degradation.

In situ bioremediation is commonly used to concurrently treat contaminated soil and groundwater. The inoculum and nutrients (aqueous mix) are delivered to the subsurface via injection or infiltration galleries and percolate through the vadose zone to the water table, coating contaminated soil as the mix moves through the subsurface. The groundwater is then recovered via extraction wells, pumped to the surface, and treated in aboveground bioreactors and/or activated carbon. The treated water is then reinjected or discharged (Kaufman 1989).

Technical Effectiveness: Bioremediation is a proven technology for a variety of contaminants including petroleum hydrocarbons; however, its potential effectiveness in remediating in situ soil zones saturated by heavy hydrocarbon mixtures is expected to be very limited.

Technical Ability to be Implemented: In situ bioremediation does not appear advantageous due to the conditions in the subsurface and the type of hydrocarbon product released. Some of the problems and conditions that limit the potential usefulness of in situ bioremediation at the Amsted site are listed below.

- The depth of HFO from the surface (over 30 feet) as well as the highly viscous nature of the product reduce the possibility of a controlled introduction and verifiable distribution of bacteria, oxygen, and nutrients into the HFO saturated zone.
- Nutrient solution may leach into the groundwater and pose a contamination threat to that media.
- The process would be slow and probably require a significant number of new borings to inject nutrients and supply oxygen.
- Achieving hydraulic control of subsurface water may require pumping large quantities of water (Section 5.2 - Pump and Treat).
- There is no guarantee that the method would be effective, and another solution (another technology) may be required to complete the remedial action objectives.

Cost: Moderate to high.

Investigate Further: No.

Justification: In situ bioremediation may not be effective with high-viscosity product in soil. Introduction of bacteria and nutrients into the product zone is difficult. Controlling the migration of groundwater containing mobilized hydrocarbons and nutrients in the subsurface would be difficult and could lead to the contamination of surrounding sites or groundwater.

#### 5.4 EXCAVATION

Description: Excavation involves the use of mechanical equipment to remove contaminated soil for offsite disposal. The equipment may include tracked backhoes, front-end loaders, clam shells, and dump trucks.

Technical Effectiveness: Backhoes and clam shells are suitable for excavating soil from the site.

Technical Ability to be Implemented: Three significant problems would be encountered using excavation as a means of remediating HFO-contaminated soils. First, surface soils in the former UST area contain elevated levels of lead and other metals. This contaminated soil is being addressed under the ongoing STF RI project. At this time, the findings of the STF Remedial Investigation/Feasibility Study (RI/FS) with respect to soil containing metals in this area are not available for review and incorporation into this review of technologies. If excavation was to be considered as a viable response to the HFO contamination, integration of the remedial action for metals-contaminated soils at Amsted developed during the STF RI/FS, with an excavation remedial response to the HFO release, would appear to be logical due to the low migratory potential associated with the HFO. Two possible scenarios are presented below.

- Surface soils containing elevated concentrations of metals could be excavated and stockpiled. Uncontaminated soil below the surface soil and above the zone of petroleum-contaminated soil could be excavated and stockpiled separately. HFO-contaminated soil could be excavated and replaced with clean imported fill. The uncontaminated soil could be put back in place and the surface soil containing elevated levels of metals would also be put back in place. Areas of the Amsted property with surface soil containing elevated metals concentrations might then be capped with a low-permeability cover.

- The soils containing elevated levels of metals would be excavated and stockpiled for offsite disposal, or they would be immediately trucked to a disposal facility. Immediate disposal would reduce the number of times the soil requires special handling.

The second significant technical problem is performing controlled excavation work to depths in excess of 30 feet BGS. The following considerations are important if excavation were to be performed.

- The soil zone containing appreciable concentrations of HFO is as much as 10 or 12 feet thick (vertically) near the point of release. The bottom of this zone is at, or slightly below, the lowest recorded water table level. An excavation to remove soils would encounter the water table. Product floating on the groundwater surface is likely to occur directly below or close to its point of release. Therefore, product and groundwater would have to be pumped from the excavation for disposal. A plan for placing, moving, and removing the recovery and excavation equipment would be required.
- Excavation is limited to approximately 20 feet because of the requirement of 1:1 (vertical:horizontal) side slopes. A hydraulic excavator can dig more than 20 feet BGS by digging a bench to work from, and then moving down to the bench. This, however, requires a significantly larger excavation.
- Installation of sheet piles and excavation with a clam shell bucket could be used instead of excavating with a hydraulic excavator. Sheet piles would be driven to form a continuous wall around the area of contamination and then braced horizontally at several levels. This method minimizes the area and volume of soil removal, but is slower than excavating with a hydraulic excavator. Installation and bracing of sheet piles would also add considerable cost to the operation.

The third significant technical problem is in performing the work with methods that pose less threat to site workers than the risks associated with no action.

Excavation and cleanup activities at the depths required to remove the HFO at this property require construction using large heavy machinery, and methods or equipment to reduce the possibility of slope failures. The risks associated with this type of construction work are probably far greater than for the potential risks from chemical exposure.

Cost: Extremely high.

Investigate Further: No.

Justification: While excavation equipment is well-suited to removing contaminated soil for offsite disposal or aboveground treatment, and soils containing HFO could be completely removed, there are significant economical and technical concerns related to this approach, as discussed above.

The excavation cost to remove the HFO-contaminated soil would be very high because of the depth of the contaminated zone and other site constraints. The cost and short-term risks to site workers incurred from excavation would be excessive when compared to the benefits derived.

## 5.5 CUTOFF

Description: A cutoff is a vertical wall of relatively impermeable material that surrounds the floating product. The wall extends vertically below and above the water table, beyond the limits of the water table seasonal fluctuation. A cutoff is constructed of earth, steel sheet piling, concrete, curtain of grout, cement/bentonite slurry, or a combination of these materials. The materials of construction and their thickness are selected for their low permeability and non-reactive characteristics, and are designed to impede the horizontal movement of product and/or



groundwater. The installation procedures vary with the materials selected, but commonly include drilling with an auger and pumping a slurry through the auger or a tremie pipe. Steel interlocking sheet piles are often driven without the use of grouts or they may be driven down through a grout curtain. Grout curtains are often softer than the surrounding formation and are free of rocks and boulders.

The problems involving surface soil containing elevated levels of metals discussed in Section 5.4 - Excavation, are also applicable to this technology.

Technical Effectiveness: Cutoffs have low permeability and would inhibit floating product or dissolved constituents from moving horizontally. Because of the remote method of grout placement, however, it may not be possible to ensure the hydraulic integrity of a grout curtain.

Technical Ability to be Implemented: Cutoffs have been used successfully in many applications for containment of contaminants and groundwater. The depth required for installation is in excess of 35 feet. Technical problems may include control of heaving sands and maintaining precise control of the auger position to construct a curtain that completely covers the vertical plane to be sealed.

Cost: High.

Investigate Further: No.

Justification: Containment using a cutoff technology is difficult to achieve at the required depth, and the effectiveness cannot be guaranteed. While cutoffs have been demonstrated to be effective in reducing the horizontal movement of contaminated groundwater, some of the same risks (e.g., worker exposure, etc.) associated with excavation would be apparent with this alternative. In addition, groundwater sampling results and the potential for migration of HFO in soil does not appear to warrant the use of a cutoff to address the contamination.

## 5.6 STEAM INJECTION AND STEAM EXTRACTION

Steam Injection Description: Steam injection has been used successfully for many years to enhance the recovery of petroleum from depleted oil and gas fields. The technology involves the introduction of steam under pressure into the target geologic formation, and the extraction of the petroleum product that is mobilized (in response to the steam injection) at a withdrawal well(s). Mobility of the petroleum product left at residual saturation in the porous geologic media is increased in response to heating and, to some extent, physical displacement by water. The mobilized product moves in response to thermal and pressure gradients to the point of extraction. In this case, mobilized petroleum product would migrate both vertically (to the water table) and horizontally and would be extracted in conjunction with groundwater pumping. Application of the technology for groundwater cleanups is somewhat rare, and use of steam injection at the Amsted property would be regarded as experimental.

Steam Stripping Description: Two counter-rotating hollow-stem auger drills inject steam and air into contaminated soil to depths of up to 30 feet BGS. The soil temperature rises, causing the vapor pressure of the volatile organic contaminants to increase. The injected air and steam carry the contaminants to the surface and transport them to a condenser that liquifies the vapors. A distillation system separates volatile organic contaminants from the water. The water is then filtered through activated carbon and used again in the steam process. Activated carbon is also used for collecting the volatile organic vapors.

Technical Effectiveness: Steam injection and steam extraction are innovative technologies. Details regarding technical effectiveness were not available.

Technical Ability to be Implemented. The technical implementation of this remedial method is impacted by soil permeability, moisture content, and organic content. Testing would be required to determine whether steam extraction can be successfully implemented at the site.

Cost: Unknown.

Investigate Further: No.

Justification: These innovative process options lack adequate performance records to accurately judge their potential effectiveness.

## 5.7 REMEDIAL ACTION SELECTION

The remedial action that provides the appropriate protection for human health and the environment is groundwater monitoring. This response action was selected for the following reasons.

- Laboratory analyses indicate that concentrations of groundwater contaminants are below drinking water standards at the property boundary. Therefore, the threat to human health appears minimal. *future situations*
- Floating HFO was not detected on the water table. Pumping alone will not remove the HFO trapped in the soil.
- Site conditions would limit the effectiveness of bioremediation, steam injection, and steam extraction. These technologies have not been well demonstrated and may have potential risks that exceed the risks of a no-action alternative.
- The costs for excavation of the HFO-contaminated soil are estimated to be very excessive compared to the benefit derived from a removal action.

If the HFO or its constituents become mobile, then the technologies presented in this section should be reexamined. Periodic groundwater sampling and analysis of

selected samples would probably provide adequate information for determining the need for future remedial action.



## 6.0 SUMMARY AND RECOMMENDED ACTION

### 6.1 SUMMARY OF FINDINGS

The extent of hydrocarbon contamination in the soil at the site appears to be generally defined. This contamination appears limited to a small portion of the Amsted property, and the free product appears to be relatively immobile. Recoverable concentrations of free-floating product on the water table using conventional technologies are not apparent. Seasonal fluctuations of the water table probably redistribute the product spatially within the soil profile. Horizontal or downgradient migration of the product along the water table, if occurring, is likely very slow. Laboratory analysis of water samples collected from the wells on the property has shown that dissolved contaminants in the groundwater were only detected at levels below those established for drinking water or at area background concentrations.

Plant operations that used the Bunker C fuel were discontinued in 1980, and the USTs were removed in 1990. The source of the product has been removed. Soil directly below the point of release, but above the water table, could be acting as a source of product to groundwater. The boring for recovery well NMW-13 contained soils that were contaminated with product above the zone of water table fluctuation. NMW-13 is probably located very close to the product release point. However, since NMW-13 does not contain a measurable thickness of product, it is unlikely that this soil is a source of product to groundwater. Downgradient migration of free-floating product has probably reached a steady-state condition, with most of the product retained in the soil pore space. \*

## 6.2 RECOMMENDED ACTION

The extent of HFO in the subsurface at the former Griffin Wheel Brass Foundry appears to have been defined. Based on field investigations, laboratory analyses of samples, and review of potential response actions, the following are the conclusions of this investigation.

- Effective recovery of any appreciable quantity of HFO found floating on the water table is either not possible using conventional technologies or could potentially spread more HFO into the saturated zone, thus increasing groundwater degradation.
- Groundwater samples collected from monitoring wells surrounding the product release and the area known to contain HFO in the soil did not contain dissolved constituents above primary drinking water standards or area background concentrations.
- Given existing site conditions, the effectiveness of in situ soil remediation technologies is uncertain since the technologies generally lack a performance record to help justify their effectiveness.
- The excavation cost to remove the HFO-contaminated soil would be very high because of the depth of the contaminated zone and other site constraints. The cost and short-term risks to site workers incurred from excavation would be excessive when compared to the benefits derived.

Based on the foregoing conclusions, it appears that long-term monitoring of groundwater is the most appropriate action for the HFO contamination in soil and groundwater.

A sampling, analysis, and reporting plan that addresses analytical parameters of concern, analytical methods, sampling frequencies, and reporting procedures should



be developed. Based on the findings, a groundwater monitoring program that includes water sampling and analysis from wells NMW-8, NMW-10, NMW-11, NMW-12, and NMW-14 should be initiated as a means of detecting possible migration of dissolved petroleum constituents in the uppermost saturated zone. Wells NMW-9, NMW-13, and MW-2 should be monitored for the presence of floating product. Further study of potential cleanup methods, as discussed in Section 5.0, would be needed if there is movement of the product, changes in the site conditions, or activities that affect the product and the integrity of the water quality of the aquifer. Sampling frequencies should be selected based on both estimated groundwater velocities rates and the results of the prior monitoring events. The plan should also contain provisions for developing and selecting remediation technologies if water quality at the property boundary degrades below drinking water standards.

Amsted anticipates the property will continue to be used for industrial use, but could institute land use controls to guarantee future use as an industrial property.

## 7.0 REFERENCES

Kaufman, A.K. 19 April 1989. "Applied Bioremedial Technology: Proceedings from HAZMACON '89." Thorne Environmental.

Kennedy/Jenks/Chilton. 1991a. South Tacoma Field QAPjP. Final Report.

Kennedy/Jenks Consultants. 1992. Work Plan, Well Installation and Monitoring, Former Griffin Wheel Brass Foundry, Tacoma, Washington. Prepared for Amsted Industries, Chicago, Illinois.

Payatakes A.C. 1982. Dynamics of Oil Ganglia During Immiscible Displacement in Wet Porous Media. Ann. Rev. Fluid Mech. 14, 365-393.

U.S. Environmental Protection Agency. 1988a; 1990a,b. Contract Laboratory Program Statements of Work. Kennedy/Jenks Consultants 1991a. South Tacoma Field QAPjP.

U.S. Environmental Protection Agency. 1988b,c,d; Laboratory Data Validation Functional Guidelines for Evaluating Organic and Inorganics Analyses. The US EPA Data Review Work Group.

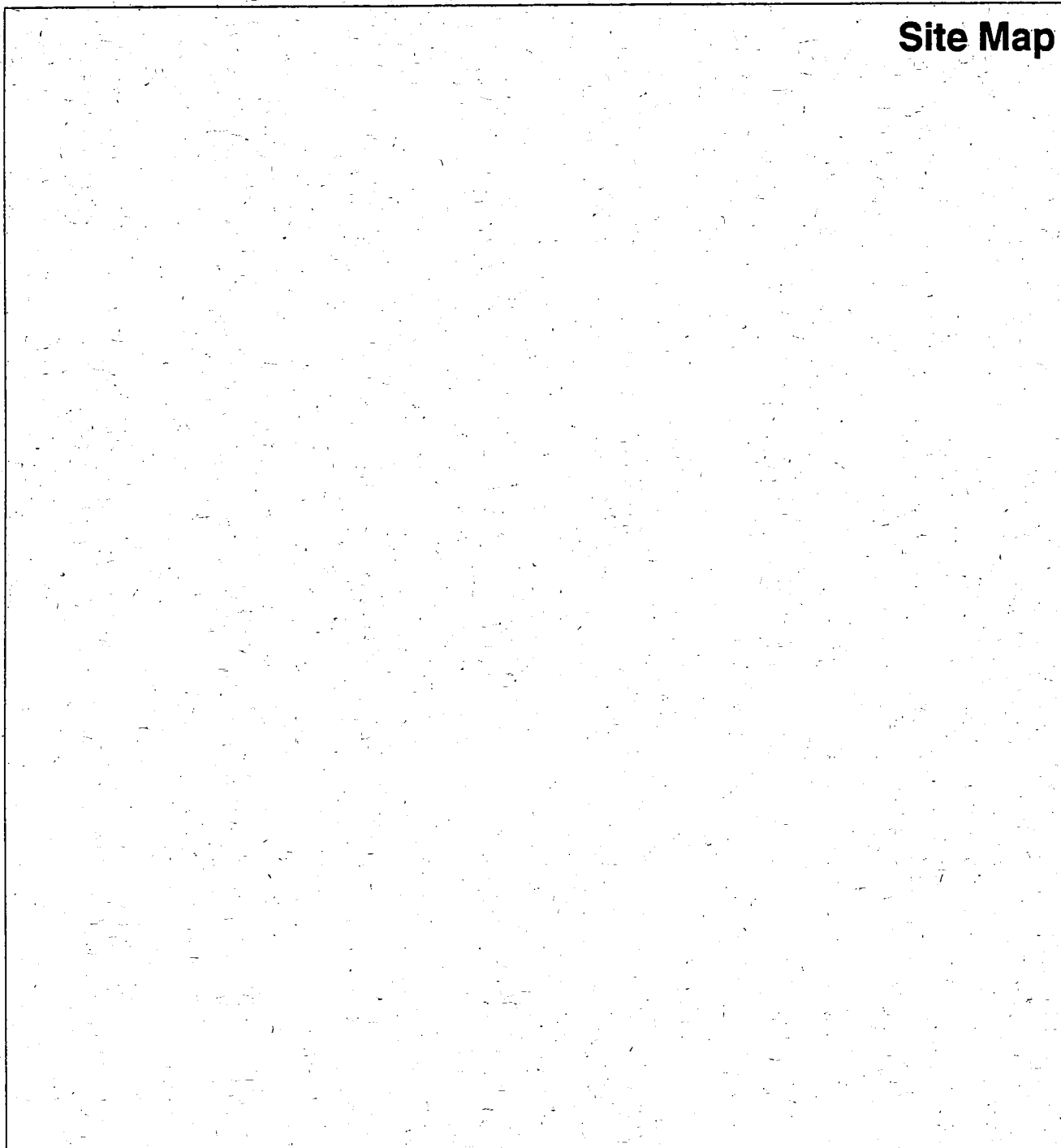
U.S. Environmental Protection Agency. 1988e. "Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA." U.S. Environmental Protection Agency Report 540/G-89/004.

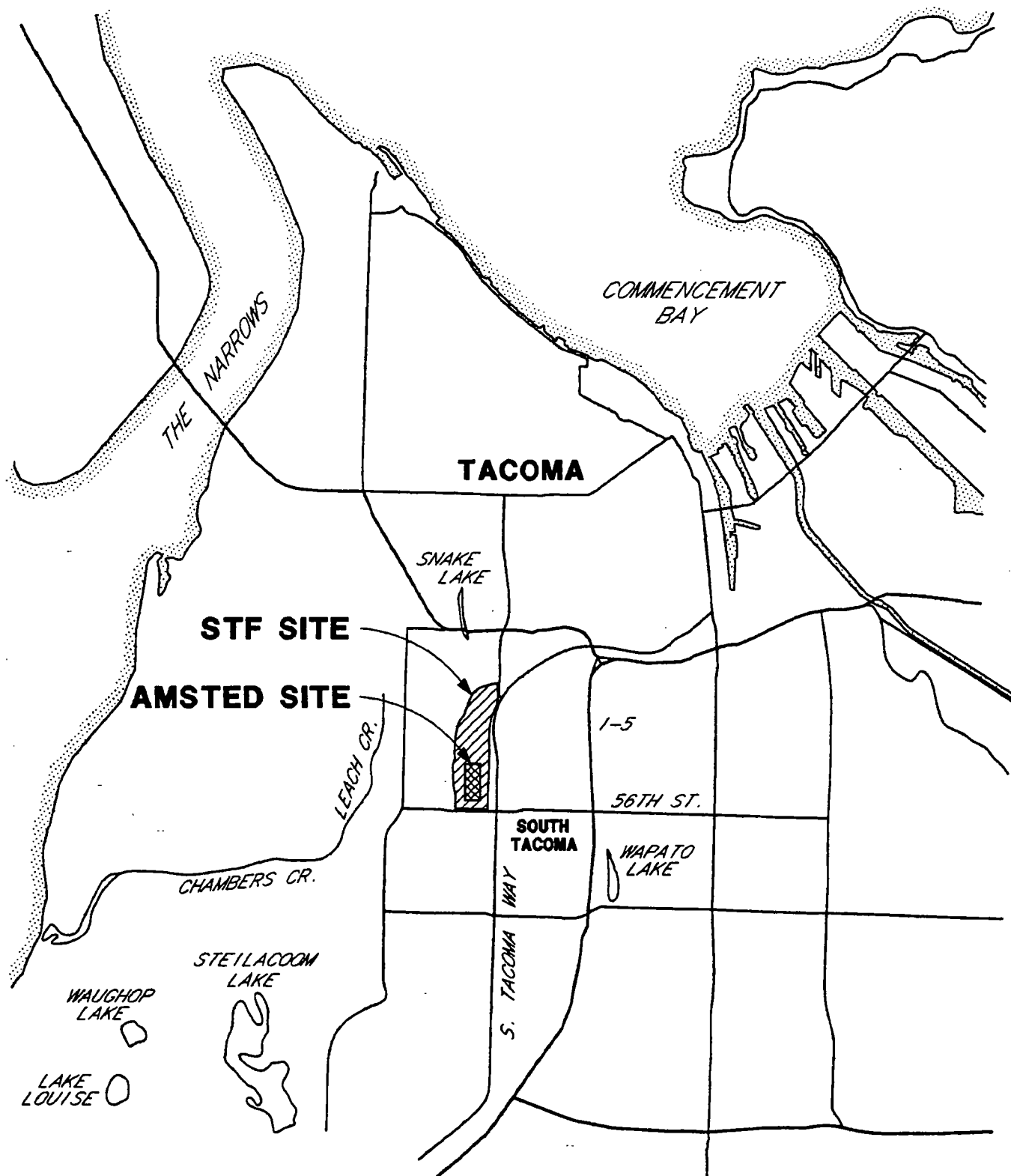
U.S. Environmental Protection Agency. 1991. EPA Region 10 Supplemental Risk Assessment Guidance for Superfund, 16 August 1991.

U.S. Environmental Protection Agency. 1992. Selection of Chemicals in Surface Soil and Air; prepared by ICF Technology Incorporated. Presented 4 May 1992 to the South Tacoma Field Group and Kennedy/Jenks Consultants. Ms. Christine Psyk, Site Manager, U.S. EPA, Region 10, Seattle, WA.

# **Appendix A**

## **Site Map**





**Kennedy/Jenks Consultants**

AMSTED INDUSTRIES  
FORMER GRIFFIN WHEEL BRASS FOUNDRY  
TACOMA, WASHINGTON

**SITE LOCATION MAP**

916058.00/P1SK001

**FIGURE 1**

## **Appendix B**

### **Partial Plan: Amsted Property Geological Cross Sections**

# TARGET SHEET

This is due to the Original being:

Other: \_\_\_\_\_

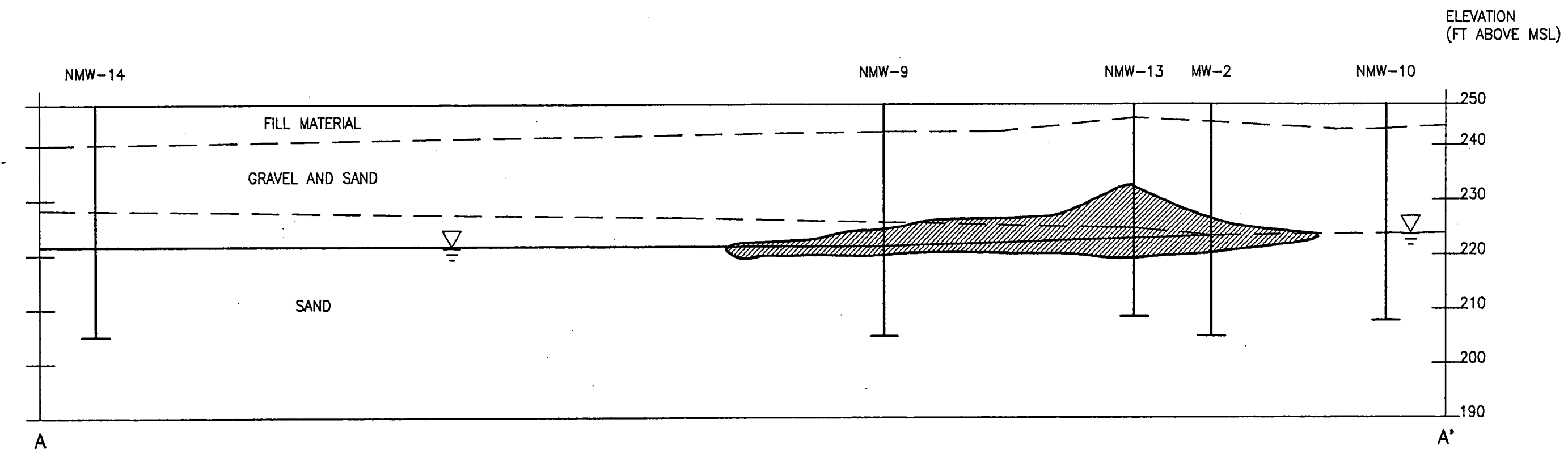
### \*Document Information\*

## Subsurface Investigation





## **Appendix C**

### **Boring and Well Construction Logs NMW-8 Sieve Analysis**



SCALE: 1"=20' FEET

- — — CONTACT, APPROXIMATE
-  ESTIMATED WATER TABLE SURFACE AT THE TIME OF WELL INSTALLATION
-  ESTIMATED EXTENT OF BUNKER "C" FUEL OIL IN SOIL

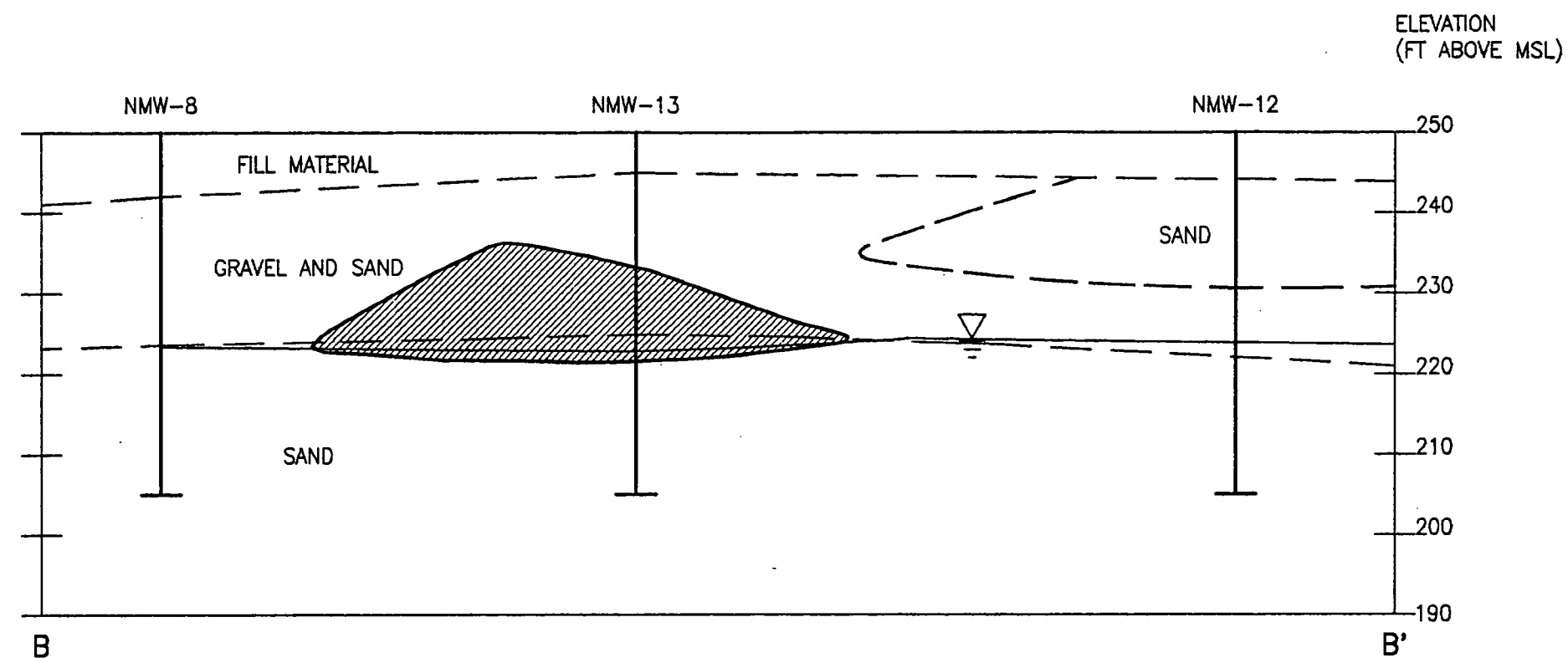
**Kennedy/Jenks Consultants**

AMSTED INDUSTRIES  
TACOMA, WA



**CROSS SECTION A-A'**

916058.00/P2SK002

**FIGURE 2**



SCALE: 1"=20' FEET

- — — CONTACT, APPROXIMATE
-  ESTIMATED WATER TABLE SURFACE AT THE TIME OF WELL INSTALLATION
-  ESTIMATED EXTENT OF BUNKER "C" FUEL OIL IN SOIL

**Kennedy/Jenks Consultants**

AMSTED INDUSTRIES  
TACOMA, WA

**CROSS SECTION B-B'**

916058.00/P2SK003

**FIGURE 3**

# MONITOR WELL NO. MW-2

## WELL SCHEMATIC

Casing Elevation: 253.63  
Casing Stickup: 3.5

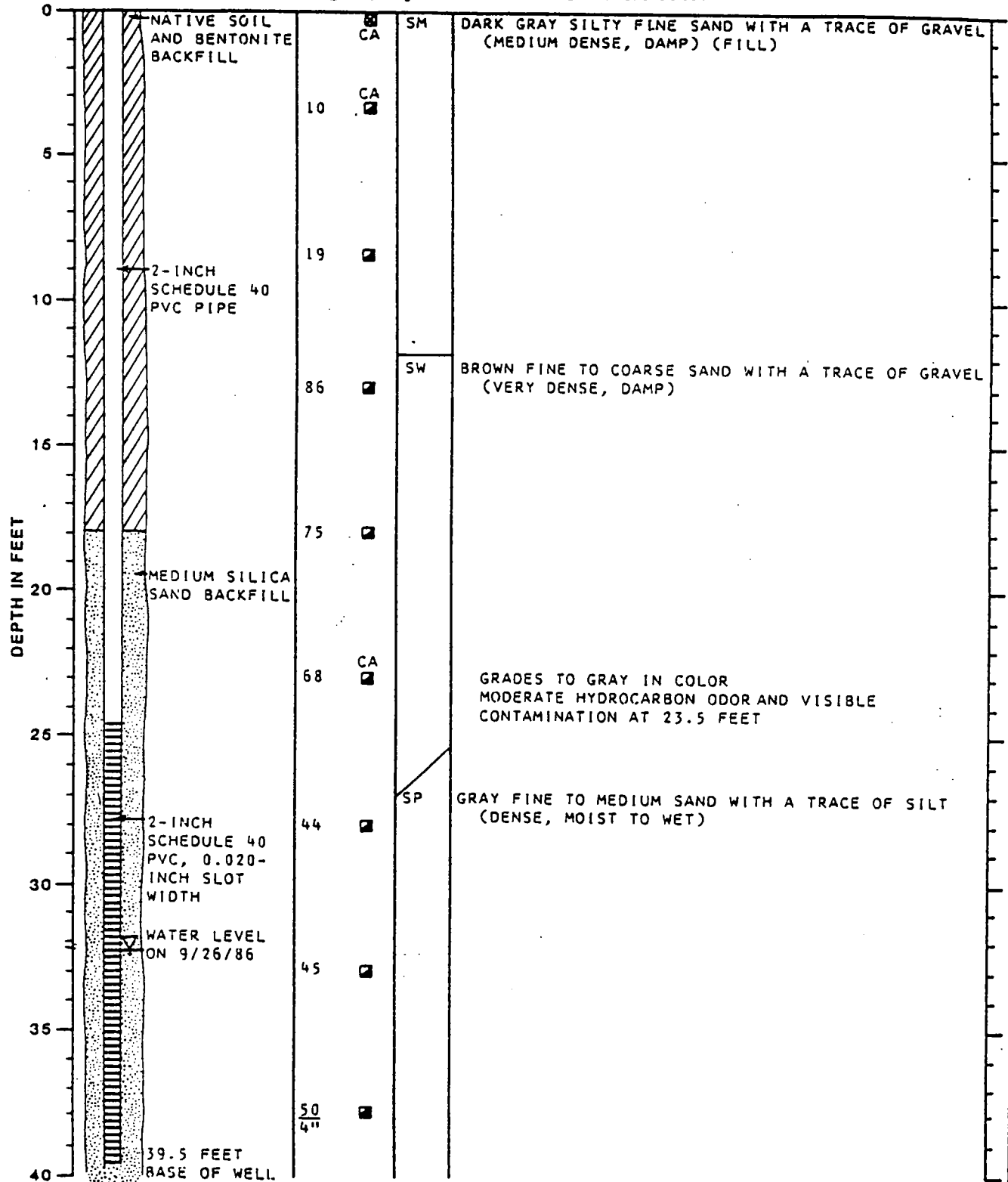
Blow-  
Count

Samples

Group  
Symbol

## DESCRIPTION

Surface Elevation: 250.1



GeoEngineers  
Incorporated

LOG OF MONITOR WELL

FIGURE A-4A

1039-01 JAM: DWP: EL 10-16-86

# **MONITOR WELL NO. MW-2** (Continued)

## **WELL SCHEMATIC**

Casing Elevation: 253.63  
Casing Stickup: 3.8

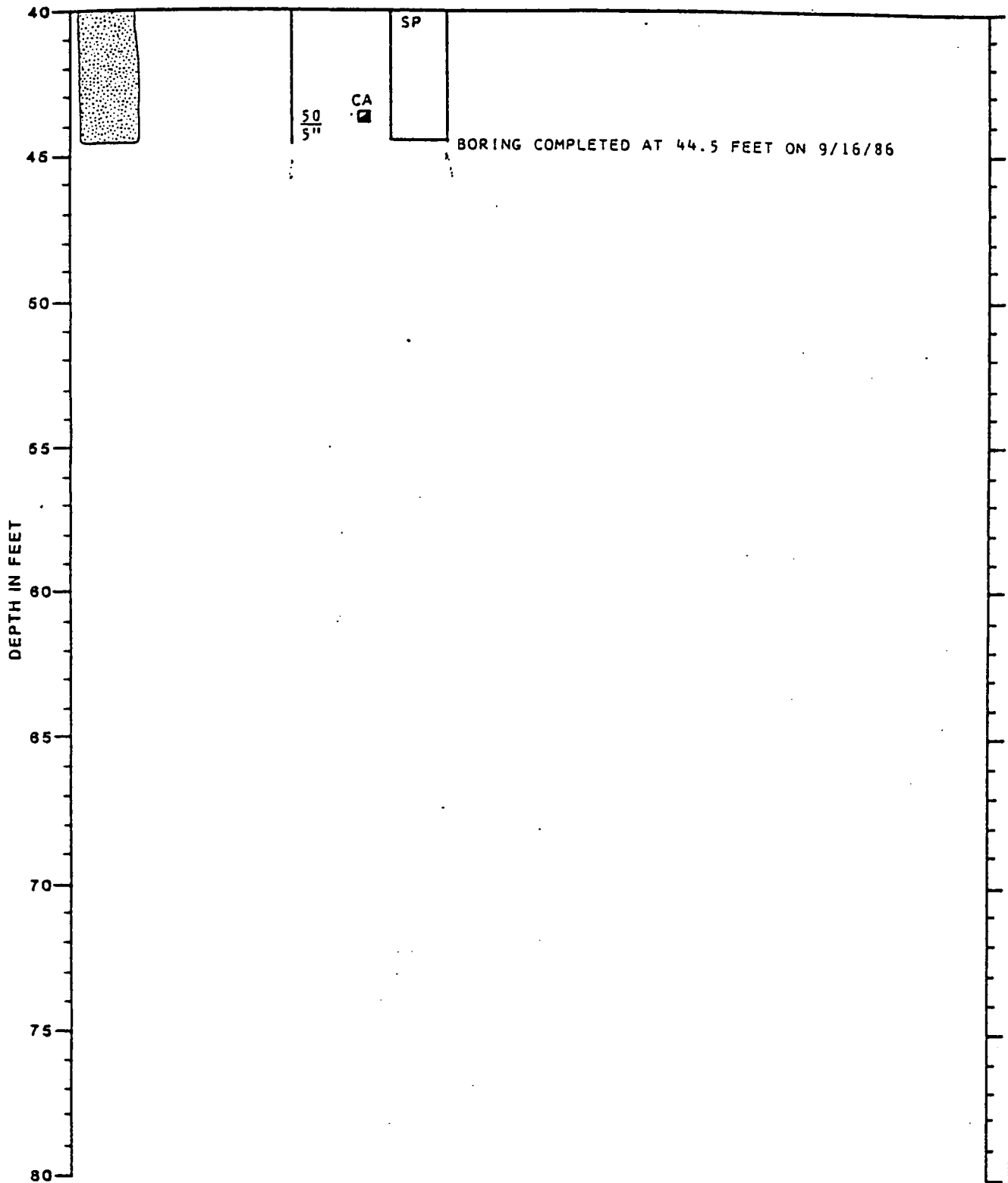
Blow-  
Count

samples

Group  
Symbol

## **DESCRIPTION**

Surface Elevation: 250.1



**GeoEngineers  
Incorporated**

**LOG OF MONITOR WELL**

**FIGURE A-4B**

1059.01 JAW. DW' 6L 10-16-86

# Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION AMSTED				Boring/Well Name NMW-8			
DRILLING COMPANY LAYNE ENVIRONMENTAL SERVICES		DRILLER KEVIN CROSS		Project Name AMSTED			
DRILLING METHOD HOLLOW STEM AUGER		DRILL BIT(S) SIZE 4 1/4" I.D.		Project Number 916058.00			
ISOLATION CASING N.A.		FROM TO FT.		ELEVATION AND DATUM		TOTAL DEPTH 42.0	
BLANK CASING 2" SCHEDULE 40 PVC		FROM 0.0 TO 17.0 FT.		DATE STARTED 03/09/1992		DATE COMPLETED 03/09/1992	
PERFORATED CASING 2", 0.020" - SLOT SCH 40 PVC		FROM 17.0 TO 42.0 FT.		INITIAL WATER DEPTH (FT) 27.0			
SIZE AND TYPE OF FILTER PACK 10-20 COLORADO SILICA SAND		FROM 14.0 TO 42.0 FT.		LOGGED BY SJR			
SEAL 1/4" BENTONITE PELLETS		FROM 12.0 TO 14.0 FT.		SAMPLING METHODS 2.5" I.D. SPLIT SPN.		WELL COMPLETION <input type="checkbox"/> SURFACE HOUSING <input checked="" type="checkbox"/> STAND PIPE _____ FT.	
GROUT CEMENT/BENTONITE MIX		FROM 0.0 TO 12.0 FT.					

SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	Penetration Resist (BLDG/IN)							
S	0.6	5 9 8 7	5	NMW-8A-4.0		4		SM	Silty SAND with gravel black, mostly fine to coarse sand, some silt and fine gravel. Plant fragments
S	1.6	16 26 26	10	NMW-8A-9.0		.1			Poorly graded GRAVEL dark yellowish brown, mostly rounded flat fine gravel, some fine to medium sand, trace silt
S	1.7	8 24 33 32	15	NMW-8A-14.0		.5			increasing sand
S	0.5	2 50	20	NMW-8A-19.0		.1		GP	decreasing sand
S	0.8	11 33 50	25	NMW-8A-24.0		.1			increasing sand, moist, wet at 27 feet
S	0.4	50		NMW-8A-26.0		.6			
S	1.5	50		NMW-8A-27.0		.6		SP	Poorly graded SAND olive gray, mostly medium sand, few fine sand
			30						



# Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name			Project Number			Boring/Well Name			
AMSTED			916058.00			NMW-8			
SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLows/ft IN)							
S	1.5	50	35	NMW-8A-34.0		1.6		SP	flowing sands into sampler
S		50	40	NMW-8A-39.0		NA			
			45						
			50						
			55						
			60						
			65						
			70						

# Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION AMSTED				Boring/Well Name NMW-9			
DRILLING COMPANY LAYNE ENVIRONMENTAL SERVICES		DRILLER KEVIN CROSS		Project Name AMSTED			
DRILLING METHOD HOLLOW STEM AUGER		DRILL BIT(S) SIZE 4 1/4" I.D.		Project Number 916058.00			
ISOLATION CASING N.A.		FROM TO FT.		ELEVATION AND DATUM		TOTAL DEPTH 45.0	
BLANK CASING 4" SCHEDULE 40 PVC		FROM -3.0 TO 17.0 FT.		DATE STARTED 03/10/1992		DATE COMPLETED 03/11/1992	
PERFORATED CASING 4", 0.020" -SLOT SCH 40 PVC		FROM 17.0 TO 42.0 FT.		INITIAL WATER DEPTH (FT) 28.0			
SIZE AND TYPE OF FILTER PACK 10-20 COLORADO SILICA SAND		FROM 14.0 TO 39.0 FT.		LOGGED BY SJR			
SEAL 1/4" BENTONITE PELLETS		FROM 12.0 TO 14.0 FT.		SAMPLING METHODS 2.5" I.D. SPLIT SPN.		WELL COMPLETION <input type="checkbox"/> SURFACE HOUSING <input checked="" type="checkbox"/> STAND PIPE _____ FT.	
GROUT CEMENT/BENTONITE MIX		FROM 0.0 TO 12.0 FT.					

SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)							
									Silty GRAVEL with sand black, mostly fine gravel, some silt, little sand. Metallic fragments.
S	0.5	2 3 4 3	5	NMW-9A-4.0		1		GM	
S	1.5	5 13 15 20	10	NMW-9A-9.0		.5			Poorly graded GRAVEL with sand dark yellowish brown, mostly rounded fine gravel, little fine to medium sand
S	1.8	18 38 47 42	15	NMW-9A-14.0		.5		GP	darker in color, increasing sand to coarse gravel
S	0.2	20 50	20	NMW-9A-19.0		1.4			moist
S	0.5	50		NMW-9A-23.0		20			strong petroleum odor, oily brown coating
S	0.5	48 50	25	NMW-9A-24.0		15			Poorly graded SAND
S	0.5	50		NMW-9A-25.0		.5			olive gray, mostly medium sand, some fine sand. Slight petroleum odor, slight sheen.
S	1.0	45 50		NMW-9A-26.0		10			Trace gravel
S	1.5	42 50 50 50		NMW-9A-27.0		1		SP	wet at 28 feet, slight sheen on water
			30						



# Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name AMSTED

Project Number 916058.00

Boring/Well Name NMW-9

SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/8 IN)							
S	1.0	13 50	35	NMW-9A-34.0		9		SP	filter pack is natural caved material from 39 feet to bottom  few silt
S	1.7	35 50	40	NMW-9A-39.0		3.5			
S	1.8	4 20 27 32	45	NMW-9A-44.0		9.5			
			50						
			55						
			60						
			65						
			70						

# Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION AMSTED				Boring/Well Name NMW-10			
DRILLING COMPANY LAYNE ENVIRONMENTAL SERVICES		DRILLER KEVIN CROSS		Project Name AMSTED			
DRILLING METHOD HOLLOW STEM AUGER		DRILL BIT(S) SIZE 4 1/4" I.D.		Project Number 916058.00			
ISOLATION CASING N.A.		FROM TO FT.		ELEVATION AND DATUM		TOTAL DEPTH 42.0	
BLANK CASING 2" SCHEDULE 40 PVC		FROM 0.0 TO 16.0 FT.		DATE STARTED 03/11/1992		DATE COMPLETED 03/12/1992	
PERFORATED CASING 2", 0.020" -SLOT SCH 40 PVC		FROM 16.0 TO 42.0 FT.		INITIAL WATER DEPTH (FT) 25.5			
SIZE AND TYPE OF FILTER PACK 10-20 COLORADO SILICA SAND		FROM 13.0 TO 41.0 FT.		LOGGED BY SJR			
SEAL 1/4" BENTONITE PELLETS		FROM 11.0 TO 13.0 FT.		SAMPLING METHODS		WELL COMPLETION	
GROUT CEMENT/BENTONITE MIX		FROM 0.0 TO 13.0 FT.		2.5" I.D. SPLIT SPN.		<input type="checkbox"/> SURFACE HOUSING <input checked="" type="checkbox"/> STAND PIPE _____ FT.	

SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLDG/S IN)							
									Silty GRAVEL with sand black, mostly angular gravel, little sand, little silt, trace scrap metal, slag
S	0.8	3 4 2 2	5	NMW-10A-4.0		2		GM	
S	1.5	13 25 24 28	10	NMW-10A-9.0		10			Poorly graded GRAVEL with sand dark yellowish brown, mostly rounded fine gravel, little medium sand, trace slag
S	1.5	11 24 25 29	15	NMW-10A-14.0		3		GP	trace coarse gravel
S	1.2	24 36 50	20	NMW-10A-19.0		5			increasing sand
S	1.0	28 50		NMW-10A-22.0		4			mostly flat gravel, moist
S	0.6	11 50	25	NMW-10A-24.0		5			wet at 25.5 feet
S	1.0	28 50		NMW-10A-26.0		1			
S	2.0	15 33 39 50		NMW-10A-27.0		10		SP	Poorly graded SAND dark yellowish brown (salt and pepper coloration), mostly medium sand, little fine sand, trace fines



# Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name			Project Number			Boring/Well Name			
AMSTED			916058.00			NMW-10			
SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLDG & BL)							
S	1.5	10 45 50	35	NMW-10A-34.0		.5		SP	
S		5 21 45 50	40	NMW-10A-39.0		9			
			45						
			50						
			55						
			60						
			65						
			70						

# Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION AMSTED				Boring/Well Name NMW-11			
DRILLING COMPANY LAYNE ENVIRONMENTAL SERVICES		DRILLER KEVIN CROSS		Project Name AMSTED			
DRILLING METHOD HOLLOW STEM AUGER		DRILL BIT(S) SIZE 4 1/4" I.D.		Project Number 916058.00			
ISOLATION CASING N.A.		FROM TO FT.		ELEVATION AND DATUM		TOTAL DEPTH 42.0	
BLANK CASING 2" SCHEDULE 40 PVC		FROM -3.0 TO 17.0 FT.		DATE STARTED 03/13/1992		DATE COMPLETED 03/13/1992	
PERFORATED CASING 2", 0.020" -SLOT SCH 40 PVC		FROM 17.0 TO 42.0 FT.		INITIAL WATER DEPTH (FT) 28.5			
SIZE AND TYPE OF FILTER PACK 10-20 COLORADO SILICA SAND		FROM 14.0 TO 42.0 FT.		LOGGED BY OGL			
SEAL 1/4" BENTONITE PELLETS		FROM 12.0 TO 14.0 FT.		SAMPLING METHODS 2.5" I.D. SPLIT SPN.		WELL COMPLETION <input type="checkbox"/> SURFACE HOUSING <input checked="" type="checkbox"/> STAND PIPE _____ FT.	
GROUT CEMENT/BENTONITE MIX		FROM 0.0 TO 12.0 FT.					

SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)							
S	0.5	3 5 2	5	NMW-11A-5.0		1	SP	Poorly graded SAND dark brown to black, contains debris including concrete, brick, and slag	
S	2.0	3 4 9	10	NMW-11A-10.0		4		mostly medium to fine sand, light brown, few fines, moist	
S	2.0	11 22 23 34	15	NMW-11A-15.0		3	GP/GM SP	Poorly graded GRAVEL with silt and sand Poorly graded SAND light brown, mostly medium to fine sand, few fines, moist	
S	0.5	9 45	20	NMW-11A-20.0		5	GW	Well-graded GRAVEL with sand light brown, mostly gravel, some sand, moist	
S	1.5	9 19 25 25	25	NMW-11A-25.0		1.5	SP	Poorly graded SAND mostly medium to fine sand, few gravel, no sheen, wet	
S	2.0	19 35 34 25	27	NMW-11A-27.0		8.2			
			30						

# Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name			Project Number			Boring/Well Name			
AMSTED			916058.00			NMW-11			
SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLDS/FT IL)							
S	1.5	2 9 30 38	35	NMW-11A-35.0		2.5		SP	
S	2.0	2 9 27 35	40	NMW-11A-40.0		9			
			45						
			50						
			55						
			60						
			65						
			70						



# Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION AMSTED				Boring/Well Name NMW-12			
DRILLING COMPANY LAYNE ENVIRONMENTAL SERVICES		DRILLER KEVIN CROSS		Project Name AMSTED -			
DRILLING METHOD HOLLOW STEM AUGER		DRILL BIT(S) SIZE 8" O.D.		Project Number 916058.00			
ISOLATION CASING N.A.		FROM TO FT.		ELEVATION AND DATUM		TOTAL DEPTH 42.0	
BLANK CASING 2" SCHEDULE 40 PVC		FROM -3.0 TO 17.0 FT.		DATE STARTED 03/12/1992		DATE COMPLETED 03/12/1992	
PERFORATED CASING 2", 0.020" -SLOT SCH 40 PVC		FROM 17.0 TO 42.0 FT.		INITIAL WATER DEPTH (FT) 27.0			
SIZE AND TYPE OF FILTER PACK 10-20 COLORADO SILICA SAND		FROM 14.0 TO 42.0 FT.		LOGGED BY SJR			
SEAL 1/4" BENTONITE PELLETS		FROM 12.0 TO 14.0 FT.		SAMPLING METHODS 2.5" I.D. SPLIT SPN.		WELL COMPLETION <input type="checkbox"/> SURFACE HOUSING <input checked="" type="checkbox"/> STAND PIPE _____ FT.	
GROUT CEMENT/BENTONITE MIX		FROM 0.0 TO 12.0 FT.					

SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLows/ft. IL)							
									Poorly graded SAND with silt and gravel fill material, orange to black, mostly fine to medium sand, some angular slag gravel, few silt
S	0.6	4 6 6	5	NMW-12A-5.0		1		SP/SM	
									Poorly graded SAND
									yellowish brown to dark yellowish brown, mostly fine sand, some medium sand
S	1.8	2 4 6 6	10	NMW-12A-10.0		.5		SP	
									Poorly graded GRAVEL with sand
									dark yellowish brown, mostly rounded fine gravel, some medium sand
S	1.6	16 32 42 44	15	NMW-12A-15.0		5		GP	
									few silt
S	0.8	4 45 50	20	NMW-12A-20.0		2			
									Poorly graded SAND
S	1.7	7 29 39 39	25	NMW-12A-23.0		2			dark yellowish brown, mostly medium sand, few fine sand, trace silt, trace coarse gravel, moist at 24 feet
S	1.5	21 37 50	25	NMW-12A-25.0		5		SP	
S	1.0	27 50	27	NMW-12A-27.0		3			wet at 27 feet, increasing fine sand
			30						

# Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name			Project Number			Boring/Well Name			
AMSTED			916058.00			NMW-12			
SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLows/ft IN.)							
S	1.0	11 50	35	NMW-12A-35.0		5		SP	some fine sand, trace silt
S	0.8	3 6 6 8	40	NMW-12A-40.0		.5			mostly medium to coarse sand, few fine sand
			45						
			50						
			55						
			60						
			65						
			70						

# Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION		AMSTED		Boring/Well Name		NMW-13	
DRILLING COMPANY		LAYNE ENVIRONMENTAL SERVICES		DRILLER		KEVIN CROSS	
DRILLING METHOD		HOLLOW STEM AUGER		DRILL BIT(S) SIZE		8 1/4" I.D.	
ISOLATION CASING		N.A.		FROM		TO FT.	
BLANK CASING		6" SCHEDULE 40 PVC		FROM		-3.0 TO 17.0 FT.	
PERFORATED CASING		6", 0.020" - SLOT SCH 40 PVC		FROM		17.0 TO 42.0 FT.	
SIZE AND TYPE OF FILTER PACK		8-12 COLORADO SILICA SAND		FROM		13.0 TO 42.0 FT.	
SEAL		3/4" BENTONITE CHIPS		FROM		11.0 TO 13.0 FT.	
GROUT		CEMENT/BENTONITE MIX		FROM		0.0 TO 11.0 FT.	
ELEVATION AND DATUM		TOTAL DEPTH		DATE STARTED		DATE COMPLETED	
		42.0		03/16/1992		03/16/1992	
INITIAL WATER DEPTH (FT)		27.0		LOGGED BY		OGL	
SAMPLING METHODS		2.5" I.D. SPLIT SPN.		WELL COMPLETION		<input type="checkbox"/> SURFACE HOUSING <input checked="" type="checkbox"/> STAND PIPE _____ FT.	

SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLows/6 IN)							
									Poorly graded GRAVEL with sand tank backfill material
S	1.0	1 2 2	5	NMW-13A-5.0		.5		GP	
S		1 2 3 4 5	10	NMW-13A-10.0		.5			Poorly graded SAND with gravel mostly sand, some gravel, dark brown to black
S	1.5	5 24 30 31	15	NMW-13A-15.0		7.5		SP	increasing gravel, dark brown, slight sheen, no odor
S	1.0	8 33	20	NMW-13A-20.0		15			gravel size increasing, heavy petroleum staining, black
S		1 16 43 45	25	NMW-13A-25.0		30		SP	Poorly graded SAND mostly medium to fine sand, stained
S		10 20 30 48	30	NMW-13A-29.5		400			

# Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name AMSTED

Project Number 916058.00

Boring/Well Name NMW-13

SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLows/in)							
S	0.7	5 9 33	35	NMW-13A-35.0		500		SP	
S		3 12 35	40	NMW-13A-40.0		10			
			45						
			50						
			55						
			60						
			65						
			70						

# Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION		AMSTED		Boring/Well Name		NMW-14	
DRILLING COMPANY		LAYNE ENVIRONMENTAL SERVICES		DRILLER		KEVIN CROSS	
DRILLING METHOD		HOLLOW STEM AUGER		DRILL BIT(S) SIZE:		4 1/4" I.D.	
ISOLATION CASING		N.A.		FROM		TO FT.	
BLANK CASING		2" SCHEDULE 40 PVC		FROM		-3.0 TO 17.0 FT.	
PERFORATED CASING		2", 0.020" -SLOT SCH 40 PVC		FROM		17.0 TO 42.0 FT.	
SIZE AND TYPE OF FILTER PACK		10-20 COLORADO SILICA SAND		FROM		14.0 TO 42.0 FT.	
SEAL		1/4" BENTONITE PELLETS		FROM		12.0 TO 14.0 FT.	
GROUT		CEMENT/BENTONITE MIX		FROM		0.0 TO 12.0 FT.	
ELEVATION AND DATUM				TOTAL DEPTH		42.0	
DATE STARTED		04/15/1992		DATE COMPLETED		04/15/1992	
INITIAL WATER DEPTH (FT)		28.0		LOGGED BY		SJR	
SAMPLING METHODS		2.5" I.D. SPLIT SPN.		WELL COMPLETION		<input type="checkbox"/> SURFACE HOUSING <input checked="" type="checkbox"/> STAND PIPE _____ FT.	

SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN)							
									<b>SILT</b> black, mostly silt, few sand, metallic particles, fill material, moist
S	1.0	2 4 3	5	NMW-14A-4.0		<0.1		ML	
									wood fragments, woody odor
S	1.5	6 8 10 14	10	NMW-14A-9.0		1		SP	<b>Poorly graded SAND</b> yellowish brown, mostly fine sand, few medium sand, trace silt, moist
S	1.5	6 14 30 31	15	NMW-14A-14.0		.5		GW	<b>Well-graded GRAVEL</b> dark yellowish brown, mostly rounded fine gravel, some sand, few silt, moist, wood fragments, woody odor
S	1.5	6 36 36 36	20	NMW-14A-19.0		1			increasing sand, wood absent
S	1.6	8 24 30 35	25	NMW-14A-24.0		5		SP	<b>Poorly graded SAND</b> salt and pepper color, mostly medium sand, some fine sand, few silt, moist
									wet at 28 feet
S	0.8	18 50	30	NMW-14A-29.0		25			dark yellowish brown, mostly fine sand, some silt

# Boring & Well Construction Log

Kennedy/Jenks Consultants

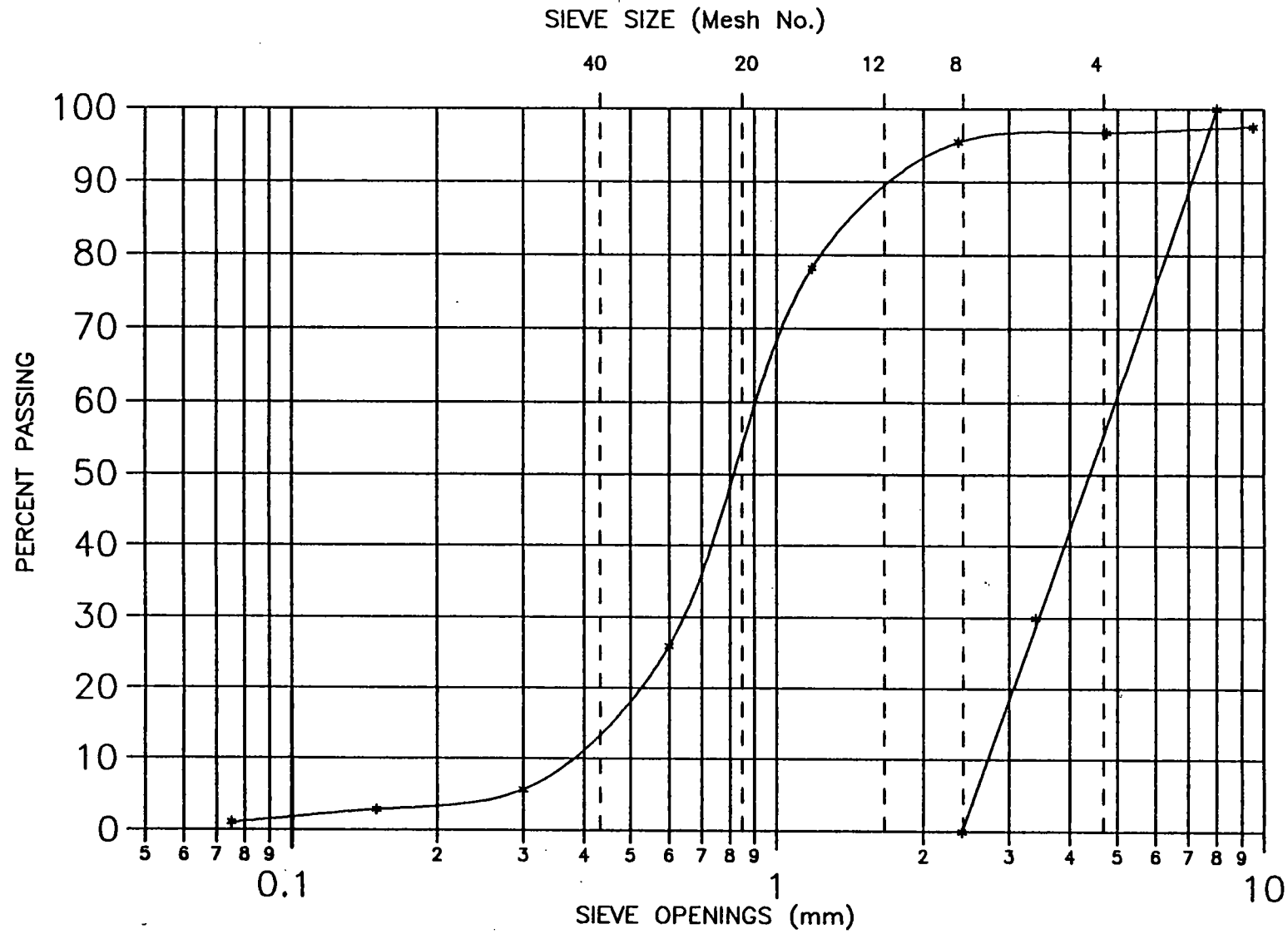
Project Name AMSTED

Project Number 916058.00

Boring/Well Name NMW-14

SAMPLES			DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLDS/8 IN)							
S	1.0	18 50	35	NMW-14A-34.0		3			mostly medium sand, some fine sand, trace silt
S	1.1	6 50	40	NMW-14A-39.0		38		SP	mostly medium sand, few gravel, few coarse sand, few silt
			45						
			50						
			55						
			60						
			65						
			70						

NMW-8



$D_{60} = 0.94$   
 $D_{30} = 0.64$   
 $D_{10} = 0.38$   
 $Cu_s = D_{60}/D_{10} = 2.47$   
 $Cu_{(fp)} = 2.5$   
 $F_{30} = 5$   
 $D_{30(fp)} = 3.2$



## **Appendix D**

### **Product Analytical Results**

**VOLATILES**

06/15/92

Page 1

STP Number	Lab Number	Chloromethane (ug/kg)	Bromomethane (ug/kg)	Vinyl Chloride (ug/kg)	Chloroethane (ug/kg)	Methylene Chloride (ug/kg)	Acetone (ug/kg)	Carbon Disulfide (ug/kg)	1,1-Dichloroethene (ug/kg)
1774 PP000000000.000	9201-140-1	U 500.0000 R	U 500.0000 R	U 50.0000 R	U 50.0000 R	B 2000.0000 R	JB 300.0000 R	U 50.0000 R	U 50.0000 R
1774 PP000000000.000	9201-140-1DP	U 500.0000	U 500.0000	U 50.0000	U 50.0000	B 790.0000 UJ	JB 340.0000 UJ	U 50.0000	U 50.0000

DATA VALIDATION	
DATE RECEIVED _____	
VALIDATED BY _____	DATE _____
KEYED BY _____	DATE _____
CHECKED BY <u>QRM</u>	DATE <u>6/15/92</u>

06/15/92

Page 2

STF Number	Lab Number	1,1-Dichloroethane (ug/kg)	1,2-Dichloroethene (total) (ug/kg)	Chloroform (ug/kg)	1,2-Dichloroethane (ug/kg)	2-Butanone (ug/kg)	1,1,1-Trichloro- ethane (ug/kg)	Carbon Tetrachloride (ug/kg)	Bromodichloro- methane (ug/kg)
1774 PP000000000.000	9201-140-1	U 50.0000 R	U 50.0000 R	U 50.0000 R	U 50.0000 R	U 500.0000 R	U 50.0000 R	U 50.0000 R	U 50.0000 R
1774 PP000000000.000	9201-140-IDP	U 50.0000	U 50.0000	U 50.0000	U 50.0000	U 500.0000 R	U 50.0000	U 50.0000	U 50.0000

06/15/92

Page 3

STF Number	Lab Number	1,2-Dichloro- propane (ug/kg)	cis-1,3-Dichloro- propene (ug/kg)	Trichloroethene (ug/kg)	Dibromochloro- methane (ug/kg)	1,1,2-Trichloro- ethane (ug/kg)	Benzene (ug/kg)	trans-1,3- Dichloropropene (ug/kg)	Bromoform (ug/kg)
1774 PP000000000.000	9201-140-1	U 50.0000 R	U 50.0000 R	U 50.0000 R	U 50.0000 R	U 50.0000 R	U 50.0000 R	U 50.0000 R	U 250.0000 R
1774 PP000000000.000	9201-140-1DP	U 50.0000	U 50.0000	U 50.0000	U 50.0000	U 50.0000	60.0000	U 50.0000	U 250.0000

06/15/92

06/15/92

Page 4

STP Number	Lab Number	4-Methyl- 2-pentanone (ug/kg)	2-Hexanone (ug/kg)	Tetrachloroethene (ug/kg)	Toluene (ug/kg)	1,1,2,2-Tetra- chloroethane (ug/kg)	Chlorobenzene (ug/kg)	Ethyl Benzene (ug/kg)	Styrene (ug/kg)
1774 PP000000000.000	9201-140-1	U 500.0000 R	U 500.0000 R	U 50.0000 R	U 50.0000 R	U 50.0000 R	U 50.0000 R	810.0000 R	U 50.0000 R
1774 PP000000000.000	9201-140-1DP	U 500.0000	U 500.0000	U 50.0000	U 50.0000	U 50.0000	U 50.0000	1800.0000	U 50.0000

06/15/92

Page 5

STP Number	Lab Number	Xylenes (total) (ug/kg)
1774 PP00000000.000	9201-140-1	420.0000 R
1774 PP00000000.000	9201-140-1DP	920.0000



06/15/92

Page 1

STF Number	Lab Number	Tentatively Identified Compounds	Qualifier	Concentration (ug/kg)	Validation
1774PP000000000.000	9201-140-1	Cyclohexane, 1,3-dimethyl-	JN	1200.00	
		Cyclohexane, 1,2-dimethyl-	JN	850.00	
		Cyclohexane, 1,1,3-trimethyl	JN	5000.00	
		Cyclohexane, 1,3,5-trimethyl	JN	850.00	
		Cyclohexane, 1,3-dimethyl-	JN	1350.00	
		UNKNOWN	JN	1800.00	
1774PP000000000.000	9201-140-1DP	UNKNOWN	JN	1400.00	
		Benzene, propyl-	JN	2050.00	
		UNKNOWN	JN	1200.00	
		Benzene, 1-ethyl-2-methyl-	JN	1100.00	
		Cyclohexane, methyl-	JN	1750.00	
		Cyclohexane, 1,2-dimethyl-	JN	3100.00	
		Cyclohexane, 1,1,3-trimethyl	JN	8500.00	
		Cyclohexane, 1,2,4-trimethyl	JN	1750.00	
		Cyclopentane, (2-methylbutyl	JN	1700.00	
		Cyclohexane, 1,1-dimethyl-	JN	2950.00	
		UNKNOWN	JN	4100.00	
		Pentalene, octahydro-2-methy	JN	3600.00	
		Benzene, propyl-	JN	4500.00	
		Benzene, 1-ethyl-2-methyl-	JN	2550.00	

DATA VALIDATION	
DATE RECEIVED	_____
VALIDATED BY	_____ DATE _____
KEYED BY	_____ DATE _____
CHECKED BY	<i>DM</i> DATE 6/15/92

06/15/92

Page 1

**SEMIVOLATILES**

06/15/92

Page 1

STF Number	Lab Number	Phenol (ug/kg)	Bis(2-Chloro- ethyl) ether (ug/kg)	2-Chlorophenol (ug/kg)	1,3-Dichloro- benzene (ug/kg)	1,4-Dichloro- benzene (ug/kg)	1,2-Dichloro- benzene (ug/kg)	2-Methylphenol (ug/kg)	2,2'-oxybis (1-Chloropropane) (ug/kg)
1774 PP000000000.000	9201-140-1	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000
1774 PP000000000.000	9201-140-1RR	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000
1774 PP000000000.000	9201-140-1A	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R
1774 PP000000000.000	9201-140-1AR	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000

DATA VALIDATION	
DATE RECEIVED	_____
VALIDATED BY	_____ DATE _____
KEYED BY	_____ DATE _____
CHECKED BY	GRM DATE 6/15/92

06/15/92

Page 2

STP Number	Lab Number	4-Methylphenol (ug/kg)	N-Nitroso-di-n- dipropylamine (ug/kg)	Hexachloroethane (ug/kg)	Nitrobenzene (ug/kg)	Isophorone (ug/kg)	2-Nitrophenol (ug/kg)	2,4-Dimethylphenol (ug/kg)	bis(2-Chloro- ethoxy) methane (ug/kg)
1774 PP000000000.000	9201-140-1	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000
1774 PP000000000.000	9201-140-1RB	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000
1774 PP000000000.000	9201-140-1A	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R
1774 PP000000000.000	9201-140-1AR	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000

06/15/92

06/15/92

Page 3

STP Number	Lab Number	2,4-Dichlorophenol (ug/kg)	1,2,4-Trichloro- benzene (ug/kg)	Naphthalene (ug/kg)	4-Chloroaniline (ug/kg)	Hexachloro- butadiene (ug/kg)	4-Chloro- 3-methylphenol (ug/kg)	2-Methyl- naphthalene (ug/kg)	Hexachlorocyclo- pentadiene (ug/kg)
1774 PP000000000.000	9201-140-1	U 5000.0000	U 5000.0000	73000.0000 J4	U 5000.0000	U 5000.0000	U 5000.0000	260000.0000 J4	U 5000.0000
1774 PP000000000.000	9201-140-1RB	U 5000.0000	U 5000.0000	83000.0000 J4	U 5000.0000	U 5000.0000	U 5000.0000	290000.0000 J4	U 5000.0000 UJ
1774 PP000000000.000	9201-140-1A	U 20000.0000 R	U 20000.0000 R	96000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	350000.0000 R	U 20000.0000 R
1774 PP000000000.000	9201-140-1AB	U 20000.0000	U 20000.0000	110000.0000	U 20000.0000	U 20000.0000	U 20000.0000	380000.0000	U 20000.0000

06/15/92

06/15/92

Page 4

STP Number	Lab Number	2,4,6-Trichloro-phenol (ug/kg)	2,4,5-Trichloro-phenol (ug/kg)	2-Chloro-naphthalene (ug/kg)	2-Nitroaniline (ug/kg)	Dimethylphthalate (ug/kg)	Acenaphthylene (ug/kg)	2,6-Dinitrotoluene (ug/kg)	3-Nitroaniline (ug/kg)
1774 PP000000000.000	9201-140-1	U 5000.0000	U 5000.0000	U 5000.0000	U 12500.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 12500.0000
1774 PP000000000.000	9201-140-1RR	U 5000.0000 UJ	U 12500.0000 UJ	U 5000.0000 UJ	U 12500.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 12500.0000 UJ
1774 PP000000000.000	9201-140-1A	U 20000.0000 R	U 50000.0000 R	U 20000.0000 R	U 50000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 50000.0000 R
1774 PP000000000.000	9201-140-1AR	U 20000.0000	U 50000.0000	U 20000.0000	U 50000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 50000.0000

06/15/92

Page 5

STP Number	Lab Number	Acenaphthene (ug/kg)	2,4-Dinitrophenol (ug/kg)	4-Nitrophenol (ug/kg)	Dibenzofuran (ug/kg)	2,4-Dinitrotoluene (ug/kg)	Diethylphthalate (ug/kg)	4-Chlorophenyl- phenylether (ug/kg)	Fluorene (ug/kg)
1774 PP000000000.000	9201-140-1	U 5000.0000	U 12500.0000	U 12500.0000	U 5000.0000	U 5000.0000	U 5000.0000	U 5000.0000	100000.0000 J4
1774 PP000000000.000	9201-140-1B	44000.0000 J4	U 12500.0000 UJ	U 12500.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	110000.0000 J4
1774 PP000000000.000	9201-140-1A	U 20000.0000 R	U 50000.0000 R	U 50000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	110000.0000 R
1774 PP000000000.000	9201-140-1AR	U 20000.0000	U 50000.0000	U 50000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	140000.0000



06/15/92

Page 6

STP Number	Lab Number	4-Nitroaniline (ug/kg)	4,6-Dinitro- 2-methylphenol (ug/kg)	N-nitrosodiphenyl- amine (ug/kg)	4-Bromophenyl- phenylether (ug/kg)	Hexachlorobenzene (ug/kg)	Pentachlorophenol (ug/kg)	Phenanthrene (ug/kg)	Anthracene (ug/kg)
1774 PP000000000.000	9201-140-1	U 12500.0000	U 12500.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	180000.0000 J4	U 5000.0000 UJ
1774 PP000000000.000	9201-140-1RE	U 12500.0000 UJ	U 12500.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 12500.0000 UJ	200000.0000 J4	U 5000.0000 UJ
1774 PP000000000.000	9201-140-1A	U 50000.0000 R	U 50000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 50000.0000 R	170000.0000 R	U 20000.0000 R
1774 PP000000000.000	9201-140-1AR	U 50000.0000	U 50000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 50000.0000	200000.0000	U 20000.0000

06/15/92

06/15/92

Page 7

STP Number	Lab Number	Carbazole (ug/kg)	Di-n-butyl- phthalate (ug/kg)	Fluoranthene (ug/kg)	Pyrene (ug/kg)	Butylbenzyl- phthalate (ug/kg)	3,3'-Dichloro- benzidine (ug/kg)	Benzo(a)anthracene (ug/kg)	Chrysene (ug/kg)
1774 PP000000000.000	9201-140-1	U 5000.0000 UJ	U 5000.0000 UJ	25000.0000 J4	66000.0000 J4	U 5000.0000 UJ	U 5000.0000 UJ	23000.0000 J4	73000.0000 J4
1774 PP000000000.000	9201-140-1RR	32000.0000 J4	U 5000.0000 UJ	32000.0000 J4	78000.0000 J4	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	77000.0000 J4
1774 PP000000000.000	9201-140-1A	U 20000.0000 R	U 20000.0000 R	35000.0000 R	69000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	59000.0000 R
1774 PP000000000.000	9201-140-1AR	U 20000.0000	U 20000.0000	39000.0000	82000.0000	U 20000.0000	U 20000.0000	U 20000.0000	62000.0000

06/15/92

06/15/92

Page 8

STP Number	Lab Number	bis(2-Ethylhexyl)- phthalate (ug/kg)	Di-n-octyl- phthalate (ug/kg)	Benzo(b)- fluoranthene (ug/kg)	Benzo(k)- fluoranthene (ug/kg)	Benzo(a)pyrene (ug/kg)	Indeno(1,2,3-cd)- pyrene (ug/kg)	Dibenzo(a,h)- anthracene (ug/kg)	Benzo(g,h,i)- perylene (ug/kg)
1774 PP000000000.000	9201-140-1	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ
1774 PP000000000.000	9201-140-1RX	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ	U 5000.0000 UJ
1774 PP000000000.000	9201-140-1A	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R	U 20000.0000 R
1774 PP000000000.000	9201-140-1AR	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000	U 20000.0000

06/15/92

Page 8

06/15/92

Page 1

STF Number	Lab Number	Tentatively Identified Compounds	Qualifier	Concentration (ug/kg)	Validation
1774PP000000000.000	9201-140-1	Unknown	JN	120000.00	
		Nonane, 2,6-dimethyl-	JN	140000.00	
		Naphthalene, decahydro-, tra	JN	240000.00	
		Unknown	JN	220000.00	
		CYCLOHEXANE, 1-METHYL-3-PROP	JN	76000.00	
		Nonane, 4,5-dimethyl-	JN	76000.00	
		CYCLOHEXANONE, 5-METHYL-2-(1	JN	144000.00	
		Undecane, 6-methyl-	JN	96000.00	
		1H-Indene, 2,3-dihydro-1,2-d	JN	150000.00	
		Unknown	JN	110000.00	
		Unknown	JN	80000.00	
		Undecane, 3,6-dimethyl-	JN	260000.00	
		Cyclopentane, 1-pentyl-2-pro	JN	164000.00	
		Unknown	JN	280000.00	
		Octane, 2,3,7-trimethyl-	JN	400000.00	
		NAPHTHALENE, 1-METHYL-	JN	80000.00	
		1,1'-Bicyclohexyl, 2-methyl-	JN	100000.00	
		Dodecane, 2,7,10-trimethyl-	JN	184000.00	
		Hexadecane	JN	70000.00	
1774PP000000000.000	9201-140-1A	Tridecane, 5-propyl-	JN	124000.00	
		1H-Indene, 2,3-dihydro-1,2-d	JN	280000.00	
		Unknown	JN	220000.00	
		Cyclohexane, (4-methylpentyl	JN	240000.00	
		Unknown	JN	300000.00	
		Cyclohexane, 2,4-diethyl-1-m	JN	260000.00	
		Octane, 2,3,7-trimethyl-	JN	520000.00	
		Cyclopentane, 2-ethyl-1,1-di	JN	280000.00	
		Unknown	JN	240000.00	
		Unknown	JN	440000.00	
		Dodecane, 2,7,10-trimethyl-	JN	680000.00	
		Naphthalene, 1,3-dimethyl-	JN	460000.00	
		Naphthalene, 1,7-dimethyl-	JN	660000.00	
		TRIDECANE, 6-PROPYL-	JN	1000000.00	
		Unknown	JN	440000.00	
		Naphthalene, 1,4,6-trimethyl	JN	340000.00	
		Docosane, 7-hexyl-	JN	380000.00	
		Naphthalene, 1,4,6-trimethyl	JN	480000.00	
		DODECANE, 2-METHYL-8-PROPYL-	JN	3400000.00	
		DOCOSANE	JN	1180000.00	
		Unknown	JN	420000.00	

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06/15/92

06/15/92

Page 2

STF Number	Lab Number	Tentatively Identified Compounds	Qualifier	Concentration (ug/kg)	Validation
1774PP0000000000.000	9201-140-1AR	1H-Indene, 2,3-dihydro-1,6-d	JN	260000.00	
		Cyclopentane, 1-methyl-2-(2-	JN	240000.00	
		Unknown	JN	300000.00	
		Cyclohexane, 1,2-diethyl-3-m	JN	320000.00	
		Octane, 2,3,7-trimethyl-	JN	500000.00	
		CYCLOPENTANE, 1-BUTYL-2-PENT	JN	260000.00	
		Unknown	JN	220000.00	
		Unknown	JN	460000.00	
		Unknown	JN	500000.00	
		Naphthalene, 1,7-dimethyl-	JN	540000.00	
		Naphthalene, 1,8-dimethyl-	JN	780000.00	
		Naphthalene, 1,2-dimethyl-	JN	720000.00	
		Dodecane, 2,7,10-trimethyl-	JN	1300000.00	
		Unknown	JN	700000.00	
		Eicosane, 7-hexyl-	JN	440000.00	
		Naphthalene, 1,6,7-trimethyl	JN	1020000.00	
		1H,3H-Thieno[3,4-c]thiophene	JN	420000.00	
		Unknown	JN	740000.00	
		Octadecane, 2,6-dimethyl-	JN	3800000.00	
		Docosane	JN	1340000.00	

06/15/92

Page 2

**PAHs**

06/15/92

Page 1

STP Number	Lab Number	Naphthalene (mg/kg)	Acenaphthylene (mg/kg)	Acenaphthene (mg/kg)	Fluorene (mg/kg)	Phenanthrene (mg/kg)	Anthracene (mg/kg)	Fluoranthene (mg/kg)	Pyrene (mg/kg)
1774 PP000000000.000	9201-140-1	U 240.0000	U 410.0000	U 240.0000	66.0000	120.0000	U 24.0000	240.0000	35.0000
1774 PP000000000.000	9201-140-1DP	U 240.0000	U 410.0000	U 240.0000	69.0000	120.0000	U 24.0000	330.0000	35.0000

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06/15/92

Page 1



06/15/92

STP Number	Lab Number	Benzo(a)anthracene (mg/kg)	Chrysene (mg/kg)	Benzo(b)- fluoranthene (mg/kg)	Benzo(k)- fluoranthene (mg/kg)	Benzo(a)pyrene (mg/kg)	Indeno(1,2,3-cd)- pyrene (mg/kg)	Dibenzo(a,h)- anthracene (mg/kg)	Benzo(g,h,i)- perylene (mg/kg)
1774 PP000000000.000	9201-140-1	U 24.0000	U 24.0000	U 24.0000	U 24.0000	U 24.0000	U 24.0000	U 48.0000	U 48.0000
1774 PP000000000.000	9201-140-IDP	U 24.0000	U 24.0000	U 24.0000	U 24.0000	U 48.0000	U 24.0000	U 48.0000	U 48.0000

06/15/92

**PESTICIDES/PCBs**

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06/15/92

Page 1

STP Number	Lab Number	alpha-BHC (ug/kg)	beta-BHC (ug/kg)	delta-BHC (ug/kg)	gamma-BHC (Lindane) (ug/kg)	Heptachlor (ug/kg)	Aldrin (ug/kg)	Heptachlor epoxide (ug/kg)	Endosulfan I (ug/kg)
1774 PP000000000.000	9201-140-1	U 48.0000	U 48.0000	U 48.0000	U 48.0000 UJ	U 48.0000	U 48.0000 UJ	U 48.0000	U 48.0000
1774 PP000000000.000	9201-140-1DP	U 48.0000	U 48.0000	U 48.0000	U 48.0000	U 48.0000	U 48.0000	U 48.0000	U 48.0000

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06/15/92

Page 1

06/15/92

Page 2

STP Number	Lab Number	Dieldrin (ug/kg)	4,4'-DDE (ug/kg)	Endrin (ug/kg)	Endosulfan II (ug/kg)	4,4'-DDD (ug/kg)	Endosulfan sulfate (ug/kg)	4,4'-DDT (ug/kg)	Methoxychlor (ug/kg)
1774 PP000000000.000	9201-140-1	U 96.0000	U 96.0000	U 96.0000 UJ	U 96.0000	U 96.0000	U 96.0000	U 96.0000	U 480.0000
1774 PP000000000.000	9201-140-1DP	U 96.0000	U 96.0000	U 96.0000	U 96.0000	U 96.0000	U 96.0000	U 96.0000	U 480.0000

06/15/92

Page 2

06/15/92

Page 3

STF Number	Lab Number	Endrin ketone (ug/kg)	alpha-Chlordane (ug/kg)	gamma-Chlordane (ug/kg)	Toxaphene (ug/kg)	Aroclor-1016 (ug/kg)	Aroclor-1221 (ug/kg)	Aroclor-1232 (ug/kg)	Aroclor-1242 (ug/kg)
1774 PP000000000.000	9201-140-1	U 96.0000	U 480.0000	U 480.0000	U 480.0000	U 480.0000	U 480.0000	U 480.0000	U 480.0000
1774 PP000000000.000	9201-140-IDP	U 96.0000	U 480.0000	U 480.0000	U 480.0000	U 480.0000	U 480.0000	U 480.0000	U 480.0000

06/15/92

Page 3

06/15/92

Page 4

STP Number	Lab Number	Aroclor-1248 (ug/kg)	Aroclor-1254 (ug/kg)	Aroclor-1260 (ug/kg)
1774 PP000000000.000	9201-140-1	U 480.0000	U 960.0000	U 960.0000
1774 PP000000000.000	9201-140-1DP	U 480.0000	U 960.0000	U 960.0000

06/15/92

## METALS



06/15/92

Page 1

STP Number	Lab Number	Aluminum (mg/kg)	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Calcium (mg/kg)	Chromium +3 (mg/kg)
1774 PP000000000.000	S20825	B 26.3000 UJ	U 6.6000	B SN 0.7900 R	B 0.2000 UJ	U 0.2000	U 0.6000	B 24.9000	0.0000
1774 PP000000000.000	S20825D	B 19.2000 UJ	U 6.6000	B 0.9000 R	U 0.2000	U 0.2000	U 0.6000	B 7.3000	0.0000

06/15/92

06/15/92

STF Number	Lab Number	Chromium +6 (mg/kg)	Total Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Magnesium (mg/kg)	Manganese (mg/kg)
1774 PP000000000.000	S20825	0.0000	U 1.0000	U 1.0000	6.5000	B 19.5000 UJ	B N 0.4600 J4	B 15.1000 UJ	B 0.9000
1774 PP000000000.000	S20825D	0.0000	U 1.0000	U 1.0000	6.0000	B 15.6000 UJ	B 0.5200 J4	U 11.0000	B 0.3700

06/15/92

Page 3

STP Number	Lab Number	Mercury (mg/kg)	Nickel (mg/kg)	Potassium (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Sodium (mg/kg)	Thallium (mg/kg)	Vanadium (mg/kg)
1774 PP000000000.000	S20825	U 0.1000	17.8000	U 173.0000	B N 0.2200 J4	U 1.2000	B 23.5000 UJ	U 0.4000 UJ	19.2000
1774 PP000000000.000	S20825D	U 0.1000	16.5000	U 173.0000	U 0.2000 UJ	U 1.2000	U 4.4000	U 0.4000 UJ	22.3000

06/15/92

Page 3

06/15/92

STP Number	Lab Number	Zinc (mg/kg)	Boron (mg/kg)	Hardness 5N 2340B (mg/kg)
1774 PP000000000.000	S20825	B 0.4600 UJ	0.0000	0.0000
1774 PP000000000.000	S20825D	B 0.7400 UJ	0.0000	0.0000

06/15/92

## **Appendix E**

### **Soil Analytical Results**

**VOLATILES**

06/11/92

Page 1

STP Number	Lab Number	Chloromethane (ug/kg)	Bromomethane (ug/kg)	Vinyl Chloride (ug/kg)	Chloroethane (ug/kg)	Methylene Chloride (ug/kg)	Acetone (ug/kg)	Carbon Disulfide (ug/kg)	1,1-Dichloroethene (ug/kg)
1790 SB310000024.001	9203-112-1	U 19.0000	U 19.0000	U 19.0000	U 19.0000	B 160.0000 UJ	B 170.0000 UJ	U 19.0000	U 19.0000
1791 SB310000027.000	9203-205-1	U 12.0000	U 12.0000	U 12.0000	U 12.0000	B 16.0000 UJ	B 80.0000 UJ	U 12.0000	U 12.0000
1794 SB310000029.500	9203-205-2	U 11.0000	U 11.0000	U 11.0000	U 11.0000	B 16.0000 UJ	B 88.0000 UJ	U 11.0000	U 11.0000
1795 SB000000039.000	9204-167-1	U 11.0000	U 11.0000	U 11.0000	U 11.0000	JB 9.0000	B 26.0000	U 11.0000	U 11.0000

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CHECKED BY <u>JRM</u>	DATE <u>6/12/92</u>

06/11/92

Page 1



06/11/92

Page 2

GTP Number Lab Number		1,1-Dichloroethane (ug/kg)	1,2-Dichloroethene (total) (ug/kg)	Chloroform (ug/kg)	1,2-Dichloroethane (ug/kg)	2-Butanone (ug/kg)	1,1,1-Trichloro- ethane (ug/kg)	Carbon Tetrachloride (ug/kg)	Bromodichloro- methane (ug/kg)
1790	SB310000024.001 9203-112-1	U 19.0000	U 19.0000	U 19.0000	U 19.0000	U 19.0000	U 19.0000	U 19.0000	U 19.0000
1791	SB310000027.000 9203-205-1	U 12.0000	U 12.0000	U 12.0000	U 12.0000	U 12.0000	U 12.0000	U 12.0000	U 12.0000
1794	SB310000029.500 9203-205-2	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1795	SB000000039.000 9204-167-1	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000

06/11/92

Page 2

06/11/92

Page 3

STF Number	Lab Number	1,2-Dichloro- propane (ug/kg)	cis-1,3-Dichloro- propene (ug/kg)	Trichloroethene (ug/kg)	Dibromochloro- methane (ug/kg)	1,1,2-Trichloro- ethane (ug/kg)	Benzene (ug/kg)	trans-1,3- Dichloropropene (ug/kg)	Bromoform (ug/kg)
1790 SB310000024.001	9203-112-1	U 19.0000	U 19.0000	U 19.0000	U 19.0000	U 19.0000	U 19.0000	U 19.0000	U 19.0000
1791 SB310000027.000	9203-205-1	U 12.0000	U 12.0000	U 12.0000	U 12.0000	U 12.0000	U 12.0000	U 12.0000	U 12.0000
1794 SB310000029.500	9203-205-2	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1795 SB000000039.000	9204-167-1	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000

06/11/92

Page 3

06/11/92

STP Number	Lab Number	4-Methyl- 2-pentanone (ug/kg)	2-Hexanone (ug/kg)	Tetrachloroethene (ug/kg)	Toluene (ug/kg)	1,1,2,2-Tetra- chloroethane (ug/kg)	Chlorobenzene (ug/kg)	Ethyl Benzene (ug/kg)	Styrene (ug/kg)
1790 SB310000024.001	9203-112-1	U 19.0000	U 19.0000	U 19.0000	U 6.0000	U 19.0000	U 19.0000	U 74.0000	U 19.0000
1791 SB310000027.000	9203-205-1	U 12.0000	U 12.0000	U 12.0000	U 12.0000	U 12.0000	U 12.0000	U 12.0000	U 12.0000
1794 SB310000029.500	9203-205-2	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1795 SB000000039.000	9204-167-1	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000

06/11/92

06/11/92

Page 5

STP Number	Lab Number	Xylenes (total) (ug/kg)
1790 SB310000024.001	9203-112-1	173.0000
1791 SB310000027.000	9203-205-1	U 12.0000
1794 SB310000029.500	9203-205-2	U 11.0000
1795 SB000000039.000	9204-167-1	U 11.0000

06/11/92

Page 5

06/11/92

Page 1

STF Number	Lab Number	Tentatively Identified Compounds	Qualifier	Concentration (ug/kg)	Validation
1790SB310000024.001	9203-112-1	Cyclohexane, 1,1,3-trimethyl	JN	270.00	
		Nonane, 3-methyl-	JN	370.00	
		Octane, 3,5-dimethyl-	JN	430.00	
		Undecane	JN	1200.00	
		Octane, 2,3,7-trimethyl-	JN	1100.00	
		UNKNOWN HYDROCARBON	JN	760.00	
		Octane, 2,5,6-trimethyl-	JN	620.00	

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06/11/92

Page 1

**SEMIVOLATILES**

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06/11/92

Page 1

STP Number	Lab Number	Phenol (ug/kg)	bis(2-Chloro- ethyl) ether (ug/kg)	2-Chlorophenol (ug/kg)	1,3-Dichloro- benzene (ug/kg)	1,4-Dichloro- benzene (ug/kg)	1,2-Dichloro- benzene (ug/kg)	2-Methylphenol (ug/kg)	2,2'-oxybis (1-Chloropropane) (ug/kg)
1790 SB310000024.001	9203-112-1	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000
1791 SB310000027.000	9203-205-1	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000
1794 SB310000029.500	9203-205-2	U 2000.0000	U 2000.0000	U 2000.0000	U 2000.0000	U 2000.0000	U 2000.0000	U 2000.0000	U 2000.0000
1795 SB000000039.000	9204-167-1	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000

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06/11/92

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Page 1

06/11/92

Page 2

STP Number	Lab Number	4-Methylphenol (ug/kg)	N-Nitroso-di-n- dipropylamine (ug/kg)	Hexachloroethane (ug/kg)	Nitrobenzene (ug/kg)	Isophorone (ug/kg)	2-Nitrophenol (ug/kg)	2,4-Dimethylphenol (ug/kg)	bis(2-Chloro- ethoxy) methane (ug/kg)
1790 SB310000024.001	9203-112-1	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000
1791 SB310000027.000	9203-205-1	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000
1794 SB310000029.500	9203-205-2	U 2000.0000	U 2000.0000	U 2000.0000	U 2000.0000	U 2000.0000	U 2000.0000	U 2000.0000	U 2000.0000
1795 SB000000039.000	9204-167-1	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000

06/11/92

Page 2



06/11/92

Page 3

STP Number	Lab Number	2,4-Dichlorophenol (ug/kg)	1,2,4-Trichloro- benzene (ug/kg)	Naphthalene (ug/kg)	4-Chloroaniline (ug/kg)	Hexachloro- butadiene (ug/kg)	4-Chloro- 3-methylphenol (ug/kg)	2-Methyl- naphthalene (ug/kg)	Hexachlorocyclo- pentadiene (ug/kg)
1790 SB310000024.001	9203-112-1	U 3700.0000	U 3700.0000	9300.0000	U 3700.0000	U 3700.0000	U 3700.0000	22000.0000	U 3700.0000
1791 SB310000027.000	9203-205-1	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000 UJ
1794 SB310000029.500	9203-205-2	U 2000.0000	U 2000.0000	J 1600.0000	U 2000.0000 UJ	U 2000.0000	U 2000.0000	3800.0000	U 2000.0000 UJ
1795 SB000000039.000	9204-167-1	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000

06/11/92

06/11/92

Page 4

STP Number	Lab Number	2,4,6-Trichloro-phenol (ug/kg)	2,4,5-Trichloro-phenol (ug/kg)	2-Chloro-naphthalene (ug/kg)	2-Nitroaniline (ug/kg)	Dimethylphthalate (ug/kg)	Acenaphthylene (ug/kg)	2,6-Dinitrotoluene (ug/kg)	3-Nitroaniline (ug/kg)
1790 SB310000024.001	9203-112-1	U 3700.0000	U 9300.0000	U 3700.0000	U 9300.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 9300.0000
1791 SB310000027.000	9203-205-1	U 400.0000	U 990.0000	U 400.0000	U 990.0000	U 400.0000	U 400.0000	U 400.0000	U 990.0000
1794 SB310000029.500	9203-205-2	U 2000.0000	U 4900.0000	U 2000.0000	U 4900.0000 R	U 2000.0000	U 2000.0000	U 2000.0000	U 4900.0000
1795 SB000000039.000	9204-167-1	U 370.0000	U 940.0000	U 370.0000	U 940.0000	U 370.0000	U 370.0000	U 370.0000	U 940.0000

06/11/92

Page 4

06/11/92

Page 5

STF Number	Lab Number	Acenaphthene (ug/kg)	2,4-Dinitrophenol (ug/kg)	4-Nitrophenol (ug/kg)	Dibenzofuran (ug/kg)	2,4-Dinitrotoluene (ug/kg)	Diethylphthalate (ug/kg)	4-Chlorophenyl- phenylether (ug/kg)	Fluorene (ug/kg)
1790 SB310000024.001	9203-112-1	J 2400.0000	U 9300.0000	U 9300.0000	J 790.0000	U 3700.0000	U 3700.0000	U 3700.0000	3800.0000
1791 SB310000027.000	9203-205-1	U 400.0000	U 990.0000 UJ	U 990.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000
1794 SB310000029.500	9203-205-2	U 2000.0000	U 4900.0000 R	U 4900.0000	J 160.0000	U 2000.0000	U 2000.0000	U 2000.0000	J 840.0000
1795 SB000000039.000	9204-167-1	U 370.0000	U 940.0000	U 940.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000

06/11/92

06/11/92

Page 6

STP Number	Lab Number	4-Nitroaniline (ug/kg)	4,6-Dinitro- 2-methylphenol (ug/kg)	N-nitrosodiphenyl- amine (ug/kg)	4-Bromophenyl- phenylether (ug/kg)	Hexachlorobenzene (ug/kg)	Pentachlorophenol (ug/kg)	Phenanthrene (ug/kg)	Anthracene (ug/kg)
1790 SB310000024.001	9203-112-1	U 9300.0000	U 9300.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 9300.0000	5100.0000	J 930.0000
1791 SB310000027.000	9203-205-1	U 990.0000	U 990.0000	U 400.0000	U 400.0000	U 400.0000	U 990.0000	U 400.0000	U 400.0000
1794 SB310000029.500	9203-205-2	U 4900.0000 UJ	U 4900.0000 UJ	U 2000.0000	U 2000.0000	U 2000.0000	U 4900.0000	J 1300.0000	J 140.0000
1795 SB000000039.000	9204-167-1	U 940.0000	U 940.0000	U 370.0000	U 370.0000	U 370.0000	U 940.0000	U 370.0000	U 370.0000

06/11/92

Page 6

06/11/92

Page 7

STP Number	Lab Number	Carbazole (ug/kg)	Di-n-butyl- phthalate (ug/kg)	Fluoranthene (ug/kg)	Pyrene (ug/kg)	Butylbenzyl- phthalate (ug/kg)	3,3'-Dichloro- benzidine (ug/kg)	Benzo(a)anthracene (ug/kg)	Chrysene (ug/kg)
1790 SB310000024.001	9203-112-1	U 3700.0000	U 3700.0000	J 310.0000	J 1300.0000	U 3700.0000	U 3700.0000	U 3700.0000	J 1100.0000
1791 SB310000027.000	9203-205-1	U 400.0000	BJ 160.0000 UJ	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000
1794 SB310000029.500	9203-205-2	U 2000.0000	U 2000.0000	J 160.0000	J 370.0000	U 2000.0000	U 2000.0000	U 2000.0000	J 330.0000
1795 SB000000039.000	9204-167-1	U 370.0000	B 1000.0000	U 370.0000	U 370.0000	J 40.0000	U 370.0000	U 370.0000	U 370.0000

06/11/92

06/11/92

Page 8

STP Number	Lab Number	bis(2-Ethylhexyl) phthalate (ug/kg)	DI-n-octyl- phthalate (ug/kg)	Benzo(b)- fluoranthene (ug/kg)	Benzo(k)- fluoranthene (ug/kg)	Benzo(a)pyrene (ug/kg)	Indeno(1,2,3-cd)- pyrene (ug/kg)	Dibenzo(a,h)- anthracene (ug/kg)	Benzo(g,h,i)- perylene (ug/kg)
1798 SB310000024.001	9203-112-1	BJ 1400.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000	U 3700.0000
1791 SB310000027.000	9203-205-1	BJ 130.0000 UJ	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000	U 400.0000
1794 SB310000029.500	9203-205-2	BJ 550.0000 UJ	U 2000.0000	U 2000.0000	J 160.0000	U 2000.0000	U 2000.0000	U 2000.0000	U 2000.0000
1795 SB000000039.000	9204-167-1	J 60.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000	U 370.0000

06/11/92

Page 8

06/15/92

Page 1

STF Number	Lab Number	Tentatively Identified Compounds	Qualifier	Concentration (ug/kg)	Validation
1790SB310000024.001	9203-112-1	1H-Indene, 2,3-dihydro-4-met	JN	5000.00	
		1H-Indene, 2,3-dihydro-1-met	JN	7800.00	
		1H-Indene, 2,3-dihydro-1,6-d	JN	13800.00	
		Dodecane, 6-methyl-	JN	10000.00	
		Unknown Hydrocarbon	JN	5200.00	
		Unknown Hydrocarbon	JN	9000.00	
		Octane, 2,3,7-trimethyl-	JN	15600.00	
		Unknown Aromatic	JN	4600.00	
		Benzene, 1-(1-methylethenyl)	JN	3800.00	
		Unknown Hydrocarbon	JN	8000.00	
		Dodecane, 2,7,10-trimethyl-	JN	8600.00	
		Naphthalene, 1-ethyl-	JN	11800.00	
		Naphthalene, 1,7-dimethyl-	JN	20000.00	
		Naphthalene, 1,2-dimethyl-	JN	36000.00	
		Naphthalene, 1,4-dimethyl-	JN	10800.00	
1791SB310000027.000	9203-205-1	Naphthalene, 1,4,6-trimethyl	JN	9400.00	
		Naphthalene, 1,6,7-trimethyl	JN	9000.00	
		Tetradecane, 2,6,10-trimethyl	JN	9400.00	
		Naphthalene, 2,3,6-trimethyl	JN	16600.00	
		Dodecane, 2-methyl-8-propyl-	JN	8800.00	
		Unknown Hydrocarbon	JNB	1380.00	
		Unknown Hydrocarbon	JNB	320.00	
		2-Cyclohexen-1-one	JN	158.00	
		BENZALDEHYDE	JNB	120.00	
		Decane	JN	100.00	
1794SB310000029.500	9203-205-2	Cyclohexane, 1,2-dichloro-,	JN	80.00	
		Unknown Hydrocarbon	JNB	120.00	
		2,3-DIHYDRO-1-METHYLINDENE	JN	1080.00	
		1H-Indene, 2,3-dihydro-1,6-d	JN	880.00	
		UNDECANE, 2,6-DIMETHYL-	JN	1560.00	
		Cyclohexane, 2-butyl-1,1,3-t	JN	880.00	
		Unknown Hydrocarbon	JN	1480.00	
		1H-Indene, 2,3-dihydro-1,3-d	JN	1280.00	
		Octane, 2,3,7-trimethyl-	JN	3200.00	
		Naphthalene, 1-methyl-	JN	1560.00	
		Cyclohexane, hexyl-	JN	1960.00	
		Naphthalene, 1,7-dimethyl-	JN	3800.00	
		Naphthalene, 1,8-dimethyl-	JN	3800.00	
		SUBSTITUTED NAPHTHALENE	JN	2600.00	
		Dodecane, 2-methyl-8-propyl-	JN	1960.00	
		NAPHTHALENE, 1,6,7-TRIMETHYL	JN	2200.00	
		Tetradecane, 2,6,10-trimethyl	JN	2600.00	
		NAPHTHALENE, 2,3,6-TRIMETHYL	JN	4200.00	
		Naphthalene, 1,2(or 2,3)-die	JN	2200.00	
		Tridecane, 5-propyl-	JN	3600.00	
		HEXADECANE, 2,6,10-TRIMETHYL	JN	8800.00	
		UNKNOWN ALKANE	JN	2400.00	

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CHECKED BY	QRM DATE 6/12/92

06/15/92

Page 1

06/15/92

STF Number	Lab Number	Tentatively Identified Compounds	Qualifier	Concentration (ug/kg)	Validation
1795SB000000039.000	9204-167-1	Unknown Hydrocarbon	JN	200.00	
		Unknown	JNB	112.00	
		Unknown	JN	132.00	
		Unknown	JN	94.00	
		Unknown	JN	112.00	
		Unknown	JN	94.00	
		Unknown	JN	74.00	
		Unknown	JN	74.00	
		Unknown	JN	94.00	

06/15/92



**METALS**

06/11/92

Page 1

STP Number	Lab Number	Aluminum (mg/kg)	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Calcium (mg/kg)	Chromium +3 (mg/kg)
1790 SB310000024.000	S22813	9640.0000	U 7.3000	SN 2.5000 J4	B 41.9000	B 0.2400	U 0.6600	4320.0000	0.0000
1791 SB310000027.000	S22814	10400.0000	U 7.9000	B N 2.2000 J4	B 40.7000	B 0.2700	U 0.7200	4460.0000	0.0000
1794 SB310000029.000	S22815	9740.0000	U 8.2000	B WN 1.6000 J4	57.7000	U 0.2500	U 0.7500	3770.0000	0.0000

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06/11/92

Page 1

06/11/92

Page 2

STP Number	Lab Number	Chromium +6 (mg/kg)	Total Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Magnesium (mg/kg)	Manganese (mg/kg)
1790 SB310000024.000	S22813	0.0000	21.3000	B 8.7000	13.3000	14900.0000	WN 1.2000 J4	5020.0000	261.0000
1791 SB310000027.000	S22814	0.0000	23.5000	B 8.4000	12.3000	15700.0000	WN 1.1000 J4	5430.0000	282.0000
1794 SB310000029.000	S22815	0.0000	20.8000	B 8.1000	20.9000	15000.0000	SN 3.0000 J4	5320.0000	237.0000

06/11/92

06/11/92

Page 3

STP Number	Lab Number		Mercury (mg/kg)	Nickel (mg/kg)	Potassium (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Sodium (mg/kg)	Thallium (mg/kg)	Vanadium (mg/kg)
1790 SB310000024.000	S22813	U	0.1100	30.6000	B 540.0000 J4	U N 0.2200 UJ	U 1.3000	B 207.0000	U 0.4400	34.4000
1791 SB310000027.000	S22814	U	0.1200	31.2000	B 603.0000 J4	U N 0.2400 UJ	U 1.4000	B 252.0000	U 0.4800	36.7000
1794 SB310000029.000	S22815	U	0.1200	30.3000	B 550.0000 J4	U N 0.2500 UJ	U 1.5000	B 255.0000	U 0.5000	30.6000

06/11/92

06/11/92

Page 4

STP Number	Lab Number	Zinc		Boron		Hardness	
		(mg/kg)		(mg/kg)		GH 23408	(mg/kg)
1790 SB310000024.000	S22813	30.8000		0.0000		0.0000	
1791 SB310000027.000	S22814	31.6000		0.0000		0.0000	
1794 SB310000029.000	S22815	33.2000		0.0000		0.0000	

06/11/92

**TOTAL PETROLEUM HYDROCARBONS**

**TABLE E-1**

**TOTAL PETROLEUM HYDROCARBONS  
DATA SUMMARY**

<b>Laboratory Number</b>	<b>ID Number</b>	<b>Total Petroleum Hydrocarbons (mg/kg)</b>
9203-112-1	1790SB310000024.001	5,300
9203-205-1	1791SB310000027.001	U 20
9203-205-2	1794SB310000029.501	1,800

916058.00

# **Appendix F**

## **Groundwater Analytical Results**



**VOLATILES**

07/06/92

Page 1

STP Number	Lab Number	Chloromethane (ug/L)	Bromomethane (ug/L)	Vinyl Chloride (ug/L)	Chloroethane (ug/L)	Methylene Chloride (ug/L)	Acetone (ug/L)	Carbon Disulfide (ug/L)	1,1-Dichloroethene (ug/L)
1773 GU000000027.000	9205-049-5	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ	U 10.0000	U 10.0000
1775 GU000000025.000	9205-049-1	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ	U 10.0000	U 10.0000
1789 GU201000042.000	9205-049-2	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ	U 10.0000	U 10.0000
1790 GU310000042.000	9205-049-11	U 10.0000	U 10.0000	U 10.0000	U 10.0000	JB 3.0000 UJ	U 10.0000 UJ	U 10.0000	U 10.0000
1791 GU310000041.000	9205-049-10	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	JB 5.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R
1793 GU000000042.000	9205-049-6	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7	U 10.0000	U 10.0000	U 10.0000	U 10.0000	JB 2.0000 UJ	U 10.0000 UJ	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R
2000 GU202000042.000	9205-049-3	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ	U 10.0000	U 10.0000
3730 WW000002000.000	9205-049-9	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ	U 10.0000	U 10.0000
3739 WW000003000.000	9205-049-4	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ	U 10.0000	U 10.0000

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07/06/92

07/06/92

Page 2

STP Number	Lab Number	1,1-Dichloroethane (ug/L)	1,2-Dichloroethane (total) (ug/L)	Chloroform (ug/L)	1,2-Dichloroethane (ug/L)	2-Butanone (ug/L)	1,1,1-Trichloro- ethane (ug/L)	Carbon Tetrachloride (ug/L)	Bromodichloro- methane (ug/L)
1773 GU000000027.000	9205-049-5	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1775 GU000000025.000	9205-049-1	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1789 GU201000042.000	9205-049-2	U 10.0000	U 10.0000	J 2.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1790 GU310000042.000	9205-049-11	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1791 GU310000041.000	9205-049-10	U 10.0000	U 10.0000	J 2.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8	U 10.0000	U 10.0000	J 2.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8R	U 10.0000 R	U 10.0000 R	J 2.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R
1793 GU000000042.000	9205-049-6	U 10.0000	U 10.0000	J 2.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R
2000 GU202000042.000	9205-049-3	U 10.0000	U 10.0000	J 2.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
3730 WW000002000.000	9205-049-9	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
3739 WW000003000.000	9205-049-4	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000

07/06/92

STP Number	Lab Number	1,2-Dichloro- propane (ug/L)	cis-1,3-Dichloro- propene (ug/L)	Trichloroethene (ug/L)	Dibromochloro- methane (ug/L)	1,1,2-Trichloro- ethane (ug/L)	Benzene (ug/L)	trans-1,3- Dichloropropene (ug/L)	Bromoform (ug/L)
1773 GU000000027.000	9205-049-5	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1775 GU000000025.000	9205-049-1	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1789 GU201000042.000	9205-049-2	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1790 GU310000042.000	9205-049-11	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1791 GU310000041.000	9205-049-10	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R
1793 GU000000042.000	9205-049-6	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R
2000 GU202000042.000	9205-049-3	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
3730 NW000002000.000	9205-049-9	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
3739 NW000003000.000	9205-049-4	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000

07/06/92

Page 4

STP Number	Lab Number	4-Methyl- 2-pentanone (ug/L)	2-Hexanone (ug/L)	Tetrachloroethene (ug/L)	Toluene (ug/L)	1,1,2,2-Tetra- chloroethane (ug/L)	Chlorobenzene (ug/L)	Ethyl Benzene (ug/L)	Styrene (ug/L)
1773 GU000000027.000	9205-049-5	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1775 GU000000025.000	9205-049-1	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1789 GU201000042.000	9205-049-2	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1790 GU310000042.000	9205-049-11	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1791 GU310000041.000	9205-049-10	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R
1793 GU000000042.000	9205-049-6	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R	U 10.0000 R
2000 GU202000042.000	9205-049-3	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
3730 WW000002000.000	9205-049-9	U 10.0000	U 10.0000	U 10.0000	J 1.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
3739 WW000003000.000	9205-049-4	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000

07/06/92

Page 4

07/06/92

Page 5

STP Number	Lab Number	Xylenes (total) (ug/L)	
1773 GU000000027.000	9205-049-5	U 10.0000	
1775 GU000000025.000	9205-049-1	U 10.0000	
1789 GU201000042.000	9205-049-2	U 10.0000	
1790 GU310000042.000	9205-049-11	U 10.0000	
1791 GU310000041.000	9205-049-10	U 10.0000	
1792 GU000000042.000	9205-049-8	U 10.0000	
1792 GU000000042.000	9205-049-8R	U 10.0000 R	
1793 GU000000042.000	9205-049-6	U 10.0000	
1795 GU310000042.000	9205-049-7	U 10.0000	
1795 GU310000042.000	9205-049-7R	U 10.0000 R	
2000 GU202000042.000	9205-049-3	U 10.0000	
3730 NW000002000.000	9205-049-9	U 10.0000	
3739 NW000003000.000	9205-049-4	U 10.0000	

07/06/92

Page 5

07/06/92

Page 1

STF Number	Lab Number	Tentatively Identified Compounds	Qualifier	Concentration (ug/L)	Validation
1773GU000000027.000	9205-049-5	HEXANE	JNB	6.00	R
1775GU000000025.000	9205-049-1	HEXANE	JNB	8.00	R
1789GU201000042.000	9205-049-2	HEXANE	JNB	6.00	R
1790GU310000042.000	9205-049-11	HEXANE	JNB	6.00	R
		2,3-DIHYDRO-1-METHYLINDENE	JN	8.00	
		1H-INDENE, 2,3-DIHYDRO-1,6D	JN	9.00	
		1H-INDENE, 2,3-DIHYDRO-1,3D	JN	7.00	
1791GU310000041.000	9205-049-10	HEXANE	JNB	7.00	R
1792GU000000042.000	9205-049-8	HEXANE	JNB	6.00	R
1793GU000000042.000	9205-049-6	HEXANE	JNB	6.00	R
1795GU310000042.000	9205-049-7	HEXANE	JNB	6.00	R
2000GU202000042.000	9205-049-3	HEXANE	JNB	7.00	R
3730WW000002000.000	9205-049-9	HEXANE	JNB	8.00	R
3739WW000003000.000	9205-049-4	HEXANE	JNB	6.00	R

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07/06/92

Page 1

**SEMIVOLATILES**



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Page 1

STP Number	Lab Number	Phenol (ug/L)	bis(2-Chloro- ethyl) ether (ug/L)	2-Chlorophenol (ug/L)	1,3-Dichloro- benzene (ug/L)	1,4-Dichloro- benzene (ug/L)	1,2-Dichloro- benzene (ug/L)	2-Methylphenol (ug/L)	2,2'-oxybis (1-Chloropropane) (ug/L)
1773 GU000000027.000	9205-049-5	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1775 GU000000025.000	9205-049-1	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1789 GU201000042.000	9205-049-2	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1790 GU310000042.000	9205-049-11	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1791 GU310000041.000	9205-049-10	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1793 GU000000042.000	9205-049-6	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
2000 GU202000042.000	9205-049-3	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
3730 NW000002000.000	9205-049-9	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000

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07/06/92

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Page 1

07/06/92

Page 2

STP Number	Lab Number	4-Methylphenol (ug/L)	N-Nitroso-di-n- dipropylamine (ug/L)	Hexachloroethane (ug/L)	Nitrobenzene (ug/L)	Isophorone (ug/L)	2-Nitrophenol (ug/L)	2,4-Dimethylphenol (ug/L)	bis(2-Chloro- ethoxy) methane (ug/L)
1773 GU000000027.000	9205-049-5	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1775 GU000000025.000	9205-049-1	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1789 GU201000042.000	9205-049-2	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1790 GU310000042.000	9205-049-11	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1791 GU310000041.000	9205-049-10	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1793 GU000000042.000	9205-049-6	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
2000 GU202000042.000	9205-049-3	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
3730 WW000002000.000	9205-049-9	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000

07/06/92

Page 2

07/06/92

Page 3

STP Number	Lab Number	2,4-Dichlorophenol (ug/L)	1,2,4-Trichloro- benzene (ug/L)	Naphthalene (ug/L)	4-Chloroaniline (ug/L)	Hexachloro- butadiene (ug/L)	4-Chloro- 3-methylphenol (ug/L)	2-Methyl- naphthalene (ug/L)	Hexachlorocyclo- pentadiene (ug/L)
1773 GU000000027.000	9205-049-5	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1775 GU000000025.000	9205-049-1	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ
1789 GU201000042.000	9205-049-2	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000 UJ
1790 GU310000042.000	9205-049-11	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1791 GU310000041.000	9205-049-10	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1793 GU000000042.000	9205-049-6	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ
1795 GU310000042.000	9205-049-7	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ
2000 GU202000042.000	9205-049-3	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000 UJ
3730 HW000002000.000	9205-049-9	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000

07/06/92

Page 3

07/06/92

Page 4

STP Number	Lab Number	2,4,6-Trichloro-phenol (ug/L)	2,4,5-Trichloro-phenol (ug/L)	2-Chloro-naphthalene (ug/L)	2-Nitroaniline (ug/L)	Dimethylphthalate (ug/L)	Acenaphthylene (ug/L)	2,6-Dinitrotoluene (ug/L)	3-Nitroaniline (ug/L)
1773 GU000000027.000	9205-049-5	U 11.0000	U 27.0000	U 11.0000	U 27.0000	U 11.0000	U 11.0000	U 11.0000	U 27.0000
1775 GU000000025.000	9205-049-1	U 10.0000	U 25.0000	U 10.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 25.0000
1789 GU201000042.000	9205-049-2	U 11.0000	U 27.0000	U 11.0000	U 27.0000	U 11.0000	U 11.0000	U 11.0000	U 27.0000
1790 GU310000042.000	9205-049-11	U 10.0000	U 25.0000	U 10.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 25.0000
1791 GU310000041.000	9205-049-10	U 10.0000	U 25.0000	U 10.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 25.0000
1792 GU000000042.000	9205-049-8	U 10.0000	U 26.0000	U 10.0000	U 26.0000	U 10.0000	U 10.0000	U 10.0000	U 26.0000
1793 GU000000042.000	9205-049-6	U 10.0000	U 25.0000	U 10.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 25.0000
1795 GU310000042.000	9205-049-7	U 10.0000	U 26.0000	U 10.0000	U 26.0000	U 10.0000	U 10.0000	U 10.0000	U 26.0000
2000 GU202000042.000	9205-049-3	U 10.0000	U 26.0000	U 10.0000	U 26.0000	U 10.0000	U 10.0000	U 10.0000	U 26.0000
3730 WW000002000.000	9205-049-9	U 10.0000	U 25.0000	U 10.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 25.0000

07/06/92

STP Number	Lab Number	Acenaphthene (ug/L)	2,4-Dinitrophenol (ug/L)	4-Nitrophenol (ug/L)	Dibenzofuran (ug/L)	2,4-Dinitrotoluene (ug/L)	Diethylphthalate (ug/L)	4-Chlorophenyl- phenylether (ug/L)	Fluorene (ug/L)
1773 GU000000027.000	9205-049-5	U 11.0000	U 27.0000	U 27.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1775 GU000000025.000	9205-049-1	U 10.0000	U 25.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1789 GU201000042.000	9205-049-2	U 11.0000	U 27.0000	U 27.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1790 GU310000042.000	9205-049-11	U 10.0000	U 25.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1791 GU310000041.000	9205-049-10	U 10.0000	U 25.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8	U 10.0000	U 26.0000	U 26.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1793 GU000000042.000	9205-049-6	U 10.0000	U 25.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7	U 10.0000	U 26.0000	U 26.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
2000 GU202000042.000	9205-049-3	U 10.0000	U 26.0000	U 26.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
3730 NW000002000.000	9205-049-9	U 10.0000	U 25.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000

07/06/92

07/06/92

Page 6

STP Number	Lab Number	4-Nitroaniline (ug/L)	4,6-Dinitro- 2-methylphenol (ug/L)	N-nitrosodiphenyl- amine (ug/L)	4-Bromophenyl- phenylether (ug/L)	Hexachlorobenzene (ug/L)	Pentachlorophenol (ug/L)	Phenanthrene (ug/L)	Anthracene (ug/L)
1773 GU000000027.000	9205-049-5	U 27.0000	U 27.0000	U 11.0000	U 11.0000	U 11.0000	U 27.0000	U 11.0000	U 11.0000
1775 GU000000025.000	9205-049-1	U 25.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 25.0000	U 10.0000	U 10.0000
1789 GU201000042.000	9205-049-2	U 27.0000	U 27.0000	U 11.0000	U 11.0000	U 11.0000	U 27.0000	U 11.0000	U 11.0000
1790 GU310000042.000	9205-049-11	U 25.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 25.0000	U 10.0000	U 10.0000
1791 GU310000041.000	9205-049-10	U 25.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 25.0000	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8	U 26.0000	U 26.0000	U 10.0000	U 10.0000	U 10.0000	U 26.0000	U 10.0000	U 10.0000
1793 GU000000042.000	9205-049-6	U 25.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 25.0000	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7	U 26.0000	U 26.0000	U 10.0000	U 10.0000	U 10.0000	U 26.0000	U 10.0000	U 10.0000
2000 GU202000042.000	9205-049-3	U 26.0000	U 26.0000	U 10.0000	U 10.0000	U 10.0000	U 26.0000	U 10.0000	U 10.0000
3730 NW000002000.000	9205-049-9	U 25.0000	U 25.0000	U 10.0000	U 10.0000	U 10.0000	U 25.0000	U 10.0000	U 10.0000

07/06/92

Page 7

STP Number	Lab Number	Carbazole (ug/L)	Di-n-butyl- phthalate (ug/L)	Fluoranthene (ug/L)	Pyrene (ug/L)	Butylbenzyl- phthalate (ug/L)	3,3'-Dichloro- benzidine (ug/L)	Benzo(a)anthracene (ug/L)	Chrysene (ug/L)
1773 GU000000027.000	9205-049-5	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1775 GU000000025.000	9205-049-1	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1789 GU201000042.000	9205-049-2	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1790 GU310000042.000	9205-049-11	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1791 GU310000041.000	9205-049-10	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1792 GU000000042.000	9205-049-8	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1793 GU000000042.000	9205-049-6	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1795 GU310000042.000	9205-049-7	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
2000 GU202000042.000	9205-049-3	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
3730 WW000002000.000	9205-049-9	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000

07/06/92

Page 8

STP Number	Lab Number	Bis(2-ethylhexyl) phthalate (ug/L)	Di-n-octyl- phthalate (ug/L)	Benzo(b)- fluoranthene (ug/L)	Benzo(k)- fluoranthene (ug/L)	Benzo(a)pyrene (ug/L)	Indeno(1,2,3-cd)- pyrene (ug/L)	Dibenzo(a,h)- anthracene (ug/L)	Benzo(g,h,i)- perylene (ug/L)
1773	GU000000027.000	9205-049-5	J 0.6000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1775	GU000000025.000	9205-049-1	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1789	GU201000042.000	9205-049-2	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000	U 11.0000
1790	GU310000042.000	9205-049-11	J 3.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1791	GU310000041.000	9205-049-10	J 0.8000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1792	GU000000042.000	9205-049-8	J 0.6000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1793	GU000000042.000	9205-049-6	J 0.7000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
1795	GU310000042.000	9205-049-7	J 0.7000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
2000	GU202000042.000	9205-049-3	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000
3730	WW000002000.000	9205-049-9	33.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000	U 10.0000



07/06/92

Page 1

STF Number	Lab Number	Tentatively Identified Compounds	Qualifier	Concentration (ug/L)	Validation
1773GU000000027.000	9205-049-5	Unknown Hydrocarbon	JNB	8.00	R
		Unknown Hydrocarbon	JNB	11.00	R
		Unknown Hydrocarbon	JNB	11.00	R
		Unknown Hydrocarbon	JNB	4.00	R
		Cyclohexane, 1-ethyl-2,3-dim	JN	3.00	
		Unknown Hydrocarbon	JN	4.00	
		Unknown Hydrocarbon	JN	4.00	
		Phenol, 2,6-bis(1,1-dimethyl	JNB	3.00	R
1775GU000000025.000	9205-049-1	Unknown Hydrocarbon	JNB	8.00	R
		Unknown Hydrocarbon	JNB	22.00	R
		Unknown Hydrocarbon	JNB	16.00	R
		Unknown Hydrocarbon	JNB	4.00	R
1789GU201000042.000	9205-049-2	Phenol, 2,6-bis(1,1-dimethyl	JNB	2.00	R
		Unknown Hydrocarbon	JNB	8.00	R
		Unknown Hydrocarbon	JNB	15.00	R
		Unknown Hydrocarbon	JNB	17.00	R
1790GU310000042.000	9205-049-11	Unknown Hydrocarbon	JNB	4.00	R
		Phenol, 2,6-bis(1,1-dimethyl	JNB	2.00	R
		Unknown Hydrocarbon	JNB	5.00	R
		Unknown Hydrocarbon	JNB	4.00	R
		Unknown Hydrocarbon	JNB	6.00	R
		Unknown Hydrocarbon	JN	2.00	
		Unknown Hydrocarbon	JN	3.00	
		Unknown Hydrocarbon	JN	2.00	
1791GU310000041.000	9205-049-10	Phenol, 2,6-bis(1,1-dimethyl	JNB	4.00	R
		Unknown Hydrocarbon	JNB	5.00	R
		Unknown Hydrocarbon	JNB	22.00	R
		Unknown Hydrocarbon	JNB	16.00	R
1792GU000000042.000	9205-049-8	Unknown Hydrocarbon	JNB	4.00	R
		PHENOL, 2,6-BIS(1,1-DIMETHYL	JNB	2.00	R
		Unknown Hydrocarbon	JNB	10.00	R
		Unknown Hydrocarbon	JNB	16.00	R
		Unknown Hydrocarbon	JNB	14.00	R
		Unknown Hydrocarbon	JNB	4.00	R
		Phenol, 2,6-bis(1,1-dimethyl	JNB	2.00	R
		Unknown Hydrocarbon	JNB	12.00	R
1793GU000000042.000	9205-049-6	2-Cyclohexen-1-one	JN	3.00	
		Unknown Hydrocarbon	JNB	18.00	R
		Unknown Hydrocarbon	JNB	16.00	R
		Unknown Hydrocarbon	JNB	4.00	R
1795GU310000042.000	9205-049-7	Unknown Hydrocarbon	JNB	7.00	R
		Unknown Hydrocarbon	JNB	13.00	R
		Unknown Hydrocarbon	JNB	15.00	R
		Unknown Hydrocarbon	JNB	4.00	R
		Ethane, 1,1'-oxybis[2-methox	JN	5.00	
		Unknown Hydrocarbon	JN	2.00	
		Unknown Hydrocarbon	JNB	9.00	R
		Unknown Hydrocarbon	JNB	19.00	R
2000GU202000042.000	9205-049-3	Unknown Hydrocarbon	JNB	14.00	R
		Unknown Hydrocarbon	JNB	4.00	R
		Phenol, 2,6-bis(1,1-dimethyl	JNB	2.00	

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07/06/92

Page 1

07/06/92

Page 2

STF Number	Lab Number	Tentatively Identified Compounds	Qualifier	Concentration (ug/L)	Validation
3730WW000002000.000	9205-049-9	Unknown Hydrocarbon	JNB	6.00	R
		Unknown Hydrocarbon	JNB	24.00	R
		Unknown Hydrocarbon	JNB	20.00	R
		Unknown Hydrocarbon	JN	2.00	
		Unknown Hydrocarbon	JNB	4.00	R
		Phenol, 2,6-bis(1,1-dimethyl	JNB	2.00	R
		Unknown Hydrocarbon	JN	2.00	

07/06/92

Page 2

**PAHs**

07/06/92

Page 1

STP Number	Lab Number	Naphthalene (ug/L)	Acenaphthylene (ug/L)	Acenaphthene (ug/L)	Fluorene (ug/L)	Phenanthrene (ug/L)	Anthracene (ug/L)	Fluoranthene (ug/L)	Pyrene (ug/L)
1773 GU000000027.000	9205-049-5	U 0.5000	U 1.0000	U 0.5000	U 0.1000	U 0.0500	U 0.0500	U 0.1000	U 0.1000
1775 GU000000025.000	9205-049-1	U 0.5000	U 1.0000	U 0.5000	U 0.1000	U 0.0500	U 0.0500	U 0.1000	U 0.1000
1789 GU201000042.000	9205-049-2	U 0.5000	U 1.0000	U 0.5000	U 0.1000	U 0.0500	U 0.0500	U 0.1000	U 0.1000
1790 GU310000042.000	9205-049-11	U 0.5000	U 1.0000	U 0.5000	U 0.1000	U 0.0500	U 0.0500	U 0.1000	U 0.1000
1791 GU310000041.000	9205-049-10	U 0.5000	U 1.0000	U 0.5000	U 0.1000	U 0.0500	U 0.0500	U 0.1000	U 0.1000
1792 GU000000042.000	9205-049-8	U 0.5000	U 1.0000	U 0.5000	U 0.1000	U 0.0500	U 0.0500	U 0.1000	U 0.1000
1793 GU000000042.000	9205-049-6	U 0.5000	U 1.0000	U 0.5000	U 0.1000	U 0.0500	U 0.0500	U 0.1000	U 0.1000
1795 GU310000042.000	9205-049-7	U 0.5000	U 1.0000	U 0.5000	U 0.1000	U 0.0500	U 0.0500	U 0.1000	U 0.1000
2000 GU202000042.000	9205-049-3	U 0.5000	U 1.0000	U 0.5000	U 0.1000	U 0.0500	U 0.0500	U 0.1000	U 0.1000
3730 WW000002000.000	9205-049-9	U 0.5000	U 1.0000	U 0.5000	U 0.1000	U 0.0500	U 0.0500	U 0.1000	U 0.1000

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07/06/92

STP Number	Lab Number	Benzo(a)anthracene (ug/L)	Chrysene (ug/L)	Benzo(b)- fluoranthene (ug/L)	Benzo(k)- fluoranthene (ug/L)	Benzo(a)pyrene (ug/L)	Indeno(1,2,3-cd)- pyrene (ug/L)	Dibenzo(a,h)- anthracene (ug/L)	Benzo(g,h,i)- perylene (ug/L)
1773 GU000000027.000	9205-049-5	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.2000	U 0.1000
1775 GU000000025.000	9205-049-1	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.2000	U 0.1000
1789 GU201000042.000	9205-049-2	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.2000	U 0.1000
1790 GU310000042.000	9205-049-11	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.2000	U 0.1000
1791 GU310000041.000	9205-049-10	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.2000	U 0.1000
1792 GU000000042.000	9205-049-8	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.2000	U 0.1000
1793 GU000000042.000	9205-049-6	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.2000	U 0.1000
1795 GU310000042.000	9205-049-7	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.2000	U 0.1000
2000 GU202000042.000	9205-049-3	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.2000	U 0.1000
3730 WH000002000.000	9205-049-9	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.2000	U 0.1000

**PESTICIDES/PCBs**

07/06/92

Page 1

STP Number	Lab Number	alpha-BHC (ug/L)	beta-BHC (ug/L)	delta-BHC (ug/L)	gamma-BHC (Lindane) (ug/L)	Heptachlor (ug/L)	Aldrin (ug/L)	Heptachlor epoxide (ug/L)	Endosulfan I (ug/L)
1773 GU000000027.000	9205-049-5	U 0.0510	U 0.0510	U 0.0510	U 0.0510	U 0.0510	U 0.0510	U 0.0510	U 0.0510
1775 GU000000025.000	9205-049-1	U 0.0520	U 0.0520	U 0.0520	U 0.0520	U 0.0520	U 0.0520	U 0.0520	U 0.0520
1789 GU201000042.000	9205-049-2	U 0.0520	U 0.0520	U 0.0520	U 0.0520	U 0.0520	U 0.0520	U 0.0520	U 0.0520
1790 GU310000042.000	9205-049-11	U 0.0500	U 0.1300	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.3400
1791 GU310000041.000	9205-049-10	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500
1792 GU000000042.000	9205-049-8	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500
1793 GU000000042.000	9205-049-6	U 0.0510	U 0.0510	U 0.0510	U 0.0510	U 0.0510	U 0.0510	U 0.0510	U 0.0510
1795 GU310000042.000	9205-049-7	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500	U 0.0500
2000 GU202000042.000	9205-049-3	U 0.0530	U 0.0530	U 0.0530	U 0.0530	U 0.0530	U 0.0530	U 0.0530	U 0.0530
3730 WW000002000.000	9205-049-9	U 0.0530	U 0.0530	U 0.0530	U 0.0530	U 0.0530	U 0.0530	U 0.0530	U 0.0530

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07/06/92

Page 1

## AMSTED

Analytical data for PESTICIDES/PCB for file AMGUP.TDBF 07/06/92 23:00:00

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Page 2

07/06/92

STP Number	Lab Number	Dieldrin (ug/L)	4,4'-DDE (ug/L)	Endrin (ug/L)	Endosulfan II (ug/L)	4,4'-DDD (ug/L)	Endosulfan sulfate (ug/L)	4,4'-DDT (ug/L)	Methoxychlor (ug/L)
1773 GU000000027.000	9205-049-5	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.5100
1775 GU000000025.000	9205-049-1	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.5200
1789 GU201000042.000	9205-049-2	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.5200
1790 GU310000042.000	9205-049-11	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.5000
1791 GU310000041.000	9205-049-10	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.5000
1792 GU000000042.000	9205-049-8	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.5000
1793 GU000000042.000	9205-049-6	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.5100
1795 GU310000042.000	9205-049-7	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.1000	U 0.5000
2000 GU202000042.000	9205-049-3	U 0.1100	U 0.1100	U 0.1100	U 0.1100	U 0.1100	U 0.1100	U 0.1100	U 0.5300
3730 WW000002000.000	9205-049-9	U 0.1100	U 0.1100	U 0.1100	U 0.1100	U 0.1000	U 0.1000	U 0.1100	U 0.5300

Analytical data for PESTICIDES/PCB for file AMGUP.TDBF 07/06/92 23:00:00

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Page 2

07/06/92



07/06/92

Page 3

STP Number	Lab Number	Endrin ketone (ug/L)	alpha-Chlordane (ug/L)	gamma-Chlordane (ug/L)	Toxaphene (ug/L)	Aroclor-1016 (ug/L)	Aroclor-1221 (ug/L)	Aroclor-1232 (ug/L)	Aroclor-1242 (ug/L)
1773 GU000000027.000	9205-049-5	U 0.1000	U 0.5100	U 0.5100	U 1.0000	U 0.5100	U 0.5100	U 0.5100	U 0.5100
1775 GU000000025.000	9205-049-1	U 0.1000	U 0.5200	U 0.5200	U 1.0000	U 0.5200	U 0.5200	U 0.5200	U 0.5200
1789 GU201000042.000	9205-049-2	U 0.1000	U 0.5200	U 0.5200	U 1.0000	U 0.5200	U 0.5200	U 0.5200	U 0.5200
1790 GU310000042.000	9205-049-11	U 0.1000	U 0.5000	U 0.5000	U 1.0000	U 0.5000	U 0.5000	U 0.5000	U 0.5000
1791 GU310000041.000	9205-049-10	U 0.1000	U 0.5000	U 0.5000	U 1.0000	U 0.5000	U 0.5000	U 0.5000	U 0.5000
1792 GU000000042.000	9205-049-8	U 0.1000	U 0.5000	U 0.5000	U 1.0000	U 0.5000	U 0.5000	U 0.5000	U 0.5000
1793 GU000000042.000	9205-049-6	U 0.1000	U 0.5100	U 0.5100	U 1.0000	U 0.5100	U 0.5100	U 0.5100	U 0.5100
1795 GU310000042.000	9205-049-7	U 0.1000	U 0.5000	U 0.5000	U 1.0000	U 0.5000	U 0.5000	U 0.5000	U 0.5000
2000 GU202000042.000	9205-049-3	U 0.1100	U 0.5300	U 0.5300	U 1.1000	U 0.5300	U 0.5300	U 0.5300	U 0.5300
3730 WW000002000.000	9205-049-9	U 0.1100	U 0.5300	U 0.5300	U 1.1000	U 0.5300	U 0.5300	U 0.5300	U 0.5300

07/06/92

Page 3

07/06/92

Page 4

STP Number	Lab Number	Aroclor-1248 (ug/L)	Aroclor-1254 (ug/L)	Aroclor-1260 (ug/L)
1773 GU000000027.000	9205-049-5	U 0.5100	U 1.0000	U 1.0000
1775 GU000000025.000	9205-049-1	U 0.5200	U 1.0000	U 1.0000
1789 GU201000042.000	9205-049-2	U 0.5200	U 1.0000	U 1.0000
1790 GU310000042.000	9205-049-11	U 0.5000	U 1.0000	U 1.0000
1791 GU310000041.000	9205-049-10	U 0.5000	U 1.0000	U 1.0000
1792 GU000000042.000	9205-049-8	U 0.5000	U 1.0000	U 1.0000
1793 GU000000042.000	9205-049-6	U 0.5100	U 1.0000	U 1.0000
1795 GU310000042.000	9205-049-7	U 0.5000	U 1.0000	U 1.0000
2000 GU202000042.000	9205-049-3	U 0.5300	U 1.1000	U 1.1000
3730 WW000002000.000	9205-049-9	U 0.5300	U 1.1000	U 1.1000

07/06/92

**METALS**

07/06/92

Page 1

STP Number	Lab Number	Aluminum (ug/L)	Antimony (ug/L)	Arsenic (ug/L)	Barium (ug/L)	Beryllium (ug/L)	Cadmium (ug/L)	Calcium (ug/L)	Chromium +3 (ug/L)
1773 GU000000027.000	W24336	U 45.0000	U 20.0000	B 1.0000	B 4.4000	U 1.0000	U 3.0000	14000.0000	0.0000
1775 GU000000025.000	W24337	B 114.0000	U 20.0000	B 4.4000	B 43.5000	U 1.0000	U 3.0000	9290.0000	0.0000
1789 GU201000042.000	W24338	891.0000	B 23.6000	U 1.0000	B 14.8000	U 1.0000	U 3.0000	12600.0000	0.0000
1790 GU310000042.000	W24339	B 98.0000	U 20.0000	U 1.0000	B 22.8000	U 1.0000	B 3.1000 UJ	35200.0000	0.0000
1791 GU310000041.000	W24340	1090.0000	U 20.0000	U 1.0000	B 12.8000	U 1.0000	U 3.0000	18600.0000	0.0000
1792 GU000000042.000	W24341	1180.0000	U 20.0000	U 1.0000	B 20.1000	U 1.0000	B 3.7000 UJ	30300.0000	0.0000
1793 GU000000042.000	W24342	832.0000	U 20.0000	U 1.0000	B 11.1000	U 1.0000	U 3.0000	22900.0000	0.0000
1795 GU310000042.000	W24343	833.0000	U 20.0000	U 1.0000	B 28.0000	U 1.0000	U 3.0000	18600.0000	0.0000
2000 GU202000042.000	W24344	877.0000	U 20.0000	U 1.0000	B 14.3000	U 1.0000	U 3.0000	13000.0000	0.0000
3730 WW000002000.000	W24345	U 45.0000	U 20.0000	U 1.0000	U 1.0000	U 1.0000	B 3.6000	U 127.0000	0.0000

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DATE RECEIVED _____	
VALIDATED BY _____	DATE _____
KEYED BY _____	DATE _____
CHECKED BY <u>QRM</u>	DATE <u>7/6/92</u>

07/06/92

Page 2

STP Number	Lab Number	Chromium +6 (ug/L)	Total Chromium (ug/L)	Cobalt (ug/L)	Copper (ug/L)	Iron (ug/L)	Lead (ug/L)	Magnesium (ug/L)	Manganese (ug/L)
1773 GU000000027.000	W24336	0.0000	U 5.0000	U 5.0000	U 1.0000	* 477.0000 J4	U WN 1.0000	B 4170.0000	154.0000
1775 GU000000025.000	W24337	0.0000	U 5.0000	B 7.6000	U W 1.0000	* 2470.0000 J4	B WN 1.3000 J4	B 4230.0000	543.0000
1789 GU201000042.000	W24338	0.0000	B 9.0000	B 5.0000	B W 3.4000 J4	* 1370.0000 J4	WN 3.9000 J4	11400.0000	74.6000
1790 GU310000042.000	W24339	0.0000	B 5.1000	B 7.3000	B W 1.7000 J4	* 196.0000 J4	B WN 2.3000 J4	27100.0000	907.0000
1791 GU310000041.000	W24340	0.0000	B 5.2000	B 5.3000	B W 2.3000 J4	* 1080.0000 J4	B WN 2.8000 J4	7530.0000	38.6000
1792 GU000000042.000	W24341	0.0000	10.1000	B 7.0000	B W 2.1000 J4	* 1460.0000 J4	WN 3.9000 J4	11200.0000	61.0000
1793 GU000000042.000	W24342	0.0000	10.1000	B 5.0000	B W 2.8000 J4	* 1140.0000 J4	B WN 2.8000 J4	9990.0000	31.3000
1795 GU310000042.000	W24343	0.0000	U 5.0000	U 5.0000	B S 20.3000	* 1180.0000 J4	WN 13.9000 J4	11700.0000	121.0000
2000 GU202000042.000	W24344	0.0000	B 9.4000	U 5.0000	B W 2.5000 J4	* 1380.0000 J4	WN 3.0000 J4	11400.0000	76.1000
3730 WW0000002000.000	W24345	0.0000	U 5.0000	U 5.0000	U 1.0000	U * 27.0000 UJ	B N 1.7000 J4	U 64.0000	U 3.0000

07/06/92

Page 3

STP Number	Lab Number	Mercury (ug/L)	Nickel (ug/L)	Potassium (ug/L)	Selenium (ug/L)	Silver (ug/L)	Sodium (ug/L)	Thallium (ug/L)	Vanadium (ug/L)
1773 GU000000027.000	W24336	U 0.2000	B 10.0000	B 1170.0000	U WN 1.0000 UJ	U 6.0000	6150.0000	U 1.0000	U 5.0000
1775 GU000000025.000	W24337	U 0.2000	U 8.0000	B 1790.0000	U WN 1.0000 UJ	U 6.0000	9860.0000	U 1.0000	U 5.0000
1789 GU201000042.000	W24338	U 0.2000	B 24.2000	B 2310.0000	U WN 1.0000 UJ	U 6.0000	5760.0000	U 1.0000	B 5.3000
1790 GU310000042.000	W24339	U 0.2000	B 43.2000	B 3230.0000	U WN 1.0000 UJ	U 6.0000	13800.0000	U 1.0000	U 5.0000
1791 GU310000041.000	W24340	U 0.2000	B 26.9000	B 1530.0000	U WN 1.0000 UJ	U 6.0000	13300.0000	U 1.0000	B 5.3000
1792 GU000000042.000	W24341	U 0.2000	B 15.6000	B 2570.0000	U WN 1.0000 UJ	U 6.0000	29600.0000	U 1.0000	B 7.0000
1793 GU000000042.000	W24342	U 0.2000	B 11.8000	B 1780.0000	U WN 1.0000 UJ	U 6.0000	10100.0000	U 1.0000	U 5.0000
1795 GU310000042.000	W24343	U 0.2000	U 8.0000	B 2780.0000	B WN 1.0000 J4	U 6.0000	27500.0000	U 1.0000	U 5.0000
2000 GU202000042.000	W24344	U 0.2000	B 20.9000	B 2260.0000	U WN 1.0000 UJ	U 6.0000	5610.0000	U 1.0000	B 6.1000
3730 WN000002000.000	W24345	U 0.2000	B 8.8000	U 746.0000	U WN 1.0000 UJ	U 6.0000	B 47.7000	U 1.0000	U 5.0000

07/06/92

Page 4

STP Number	Lab Number	Zinc (ug/L)	Boron (ug/L)	Hardness EN 2340B (ug/L)	
1773 GU000000027.000	W24336	* 42.6000 J4	49.6000 UJ	0.0000	
1775 GU000000025.000	W24337	B * 19.8000 UJ	96.0000	0.0000	
1789 GU201000042.000	W24338	* 63.5000 J4	191.0000	0.0000	
1790 GU310000042.000	W24339	B * 7.6000 UJ	53.7000 UJ	0.0000	
1791 GU310000041.000	W24340	B * 10.7000 UJ	53.0000 UJ	0.0000	
1792 GU000000042.000	W24341	B * 8.9000 UJ	107.0000	0.0000	
1793 GU000000042.000	W24342	B * 16.1000 UJ	65.6000	0.0000	
1795 GU310000042.000	W24343	* 28.7000 J4	130.0000	0.0000	
2000 GU202000042.000	W24344	B * 13.7000 UJ	191.0000	0.0000	
3730 WW000002000.000	W24345	* 32.4000 J4	14.3000	0.0000	

07/06/92

CYANIDE



07/06/92

Page 1

STP Number	Lab Number	Cyanide (ug/L)	
1773 GU000000027.000	W24436	U 10.0000	
1775 GU000000025.000	W24337	U 10.0000	
1789 GU201000042.000	W24338	U 10.0000	
1790 GU310000042.000	W24339	U 10.0000	
1791 GU310000041.000	W24340	U 10.0000	
1792 GU000000042.000	W24341	U 10.0000	
1793 GU000000042.000	W24342	U 10.0000	
1795 GU310000042.000	W24343	U 10.0000	
2000 GU202000042.000	W24344	U 10.0000	
3730 WU0000002000.000	W24345	U 10.0000	

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VALIDATED BY _____	DATE _____
KEYED BY _____	DATE _____
CHECKED BY <u>SRM</u>	DATE <u>7/6/92</u>

07/06/92

Page 1

TOC

07/06/92

Page 1

STP Number	Lab Number	Total Organic Carbon (EPA 9060) (ug/L)
1773 GU000000027.000	W24336	3400.0000
1775 GU000000025.000	W24337	2000.0000
1789 GU201000042.000	W24338	1600.0000
1790 GU310000042.000	W24339	11200.0000
1791 GU310000041.000	W24340	1600.0000
1792 GU000000042.000	W24341	31600.0000
1793 GU000000042.000	W24342	U 1000.0000
1795 GU310000042.000	W24343	U 1000.0000
2000 GU202000042.000	W24344	1470.0000
3730 W00000002000.000	W24345	U 1000.0000

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**TOTAL PETROLEUM HYDROCARBONS**

**TABLE F-1****TOTAL PETROLEUM HYDROCARBONS  
DATA SUMMARY**

<b>Laboratory Number</b>	<b>ID Number</b>	<b>Total Petroleum Hydrocarbons (mg/L)</b>	
9205-049-5	1773GU000000027.000	U	1.0
9205-049-1	1775GU000000025.000	U	1.0
9205-049-2	1789GU201000042.000	U	1.0
9205-049-11	1790GU310000042.000	U	1.0
9205-049-10	1791GU310000041.000	U	1.0
9205-049-8	1792GU000000042.000	U	1.0
9205-049-6	1793GU000000042.000	U	1.0
9205-049-7	1795GU310000042.000	U	1.0
9205-049-3	2000GU202000042.000	U	1.0
9205-049-9	3730WW000002000.000	U	1.0

**TDS and TSS**

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Analytical data for TOTAL SUSPENDED AND TOTAL DISSOLVED SOLIDS for file AMGUTS.DBF 07/06/92 23:00:00

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Page 1

STP Number	Lab Number	Total Dissolved		Total Suspended	
		Solids (BPA 106.1)		Solids (BPA 160.2)	
		(mg/L)		(mg/L)	
1773	GU000000027.000	9205-049-5	130.0000	U	10.0000
1775	GU000000025.000	9205-049-1	150.0000		15.0000
1789	GU201000042.000	9205-049-2	150.0000		36.0000
1790	GU310000042.000	9205-049-11	280.0000		10.0000
1791	GU310000041.000	9205-049-10	160.0000		62.0000
1792	GU000000042.000	9205-049-8	260.0000		43.0000
1793	GU000000042.000	9205-049-6	100.0000		22.0000
1795	GU310000042.000	9205-049-7	220.0000		17.0000
2000	GU202000042.000	9205-049-3	170.0000		38.0000
3730	WW000002000.000	9205-049-9	27.0000	U	10.0000

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Analytical data for TOTAL SUSPENDED AND TOTAL DISSOLVED SOLIDS for file AMGUTS.DBF 07/06/92 23:00:00

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Page 1

# **Appendix G**

## **Validation Reports**



## **GROUNDWATER VALIDATION REPORT**

**DATA VALIDATION REPORT**

**Amsted Groundwater Investigation**

Prepared for:

Kennedy/Jenks Consultants  
530 South 336th Street  
Federal Way, Wa. 98003

Prepared by:

**EcoChem, Inc.**  
**911 Western Avenue**  
**Suite 523**  
**Seattle, WA 98104**

Contract: 2307

July 7, 1992  
Final

**Amsted Groundwater Investigation**

**CONTRACT LABORATORIES:**

**Volatile Organics, Semivolatile Organics, Pesticides/PCBs, Polynuclear Aromatic  
Hydrocarbons, Total Petroleum Hydrocarbons, TSS, TDS:**

Analytical Technologies, Inc. (ATI-Renton)  
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**DATA VALIDATION**

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## INTRODUCTION

The submitted data packages have been reviewed by EcoChem, Inc. Data validation packets for the organics and inorganics analyses, which detail items reviewed, are on file at EcoChem. The quality assurance evaluations performed and the resulting data qualification recommendations are summarized in the following sections:

- Volatile Organic Analyses
- Semivolatile Analyses
- Pesticide/PCB Analyses
- Polynuclear Aromatic Hydrocarbon Analyses
- Total Metals, Low-level Copper, Boron and Cyanide Analyses
- Total Petroleum Hydrocarbon Analyses
- Total Dissolved Solids and Total Suspended Solids Analyses

Recommended data qualifiers are based on the EPA Data Validation Functional Guidelines (U.S. EPA, 1988b,c,d). These guidelines require that the data reviewer use professional judgment to designate data qualifiers, but do not replace those assigned by the laboratory. Data may be qualified even though the laboratory fulfilled all the requirements stated in the EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for a particular analysis (U.S. EPA, 1988a, 1990a,b). Unless specifically stated in the text, data qualifications are not due to laboratory error or deviations from the analysis protocols defined in the EPA SOW, but are based on EPA data validation guidelines.

EcoChem, Inc.'s goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are assigned a J or UJ, data can be used for site evaluation purposes, but reasons for data qualification should be taken into consideration when interpreting sample concentrations. If values are assigned an R, the data are to be rejected and should not be used for any site evaluation purposes. If values have no data qualifier assigned, then the data meet all data quality goals as outlined in the EPA Functional Guidelines and as required by the South Tacoma Field Superfund Site Quality Assurance Project Plan, March, 1991.

Holding times, sample integrity and required analyses were determined by review of the chain-of-custody sheets. Chain-of-custody records were received for all samples. A summary of the samples reviewed is provided in Table 1.

**Table 1. Amsted Groundwater Investigation Sample Index**

KJC Sample ID	VOA	SV	P/PCB	PAH	Metals+B+CN	TPH	TSS/TDS
1773GU000000027.000	X	X	X	X	X	X	X
1775GU000000025.000	X	X	X	X	X	X	X
1789GU201000042.000	X	X	X	X	X	X	X
1790GU310000042.000	X	X	X	X	X	X	X
1791GU310000041.000	X	X	X	X	X	X	X
1792GU000000042.000	X	X	X	X	X	X	X
1793GU000000042.000	X	X	X	X	X	X	X
1795GU310000042.000	X	X	X	X	X	X	X
2000GU202000042.000	X	X	X	X	X	X	X
3730WW000002000.000	X	X	X	X	X	X	X
3739WW000003000.000	X						

**Key:**

**VOA** = Volatile Organic Compounds

**SV** = Semivolatile Organic Compounds

**P/PCB** = TCL Pesticides and Polychlorinated Biphenyls

**PAH** = Polynuclear Aromatic Hydrocarbons

**Metals** = TCL Metals and Low-level Copper

**B** = Boron

**CN** = Cyanide

**TPH** = Total Petroleum Hydrocarbons

**TSS/TDS** = Total Suspended/Dissolved Solids

## REFERENCES

- Kennedy/Jenks/Chilton. 1991. Quality Assurance Project Plan South Tacoma Field Superfund Site, Tacoma, Wa. March.
- U.S. Environmental Protection Agency. 1988a. Contract Laboratory Program Statement of Work for Pesticides/PCBs.
- U.S. Environmental Protection Agency. 1988b. Functional Guidelines for Evaluating Inorganic Analyses.
- U.S. Environmental Protection Agency. 1988c. Functional Guidelines for Evaluating Organic Analyses. R-582-5-5-01.
- U.S. Environmental Protection Agency. 1988d. Functional Guidelines for Evaluating Pesticide/PCB Analyses. R-582-5-5-01.
- U.S. Environmental Protection Agency. 1990a. Contract Laboratory Program Statements of Work for Inorganics. ILM01.0.
- U.S. Environmental Protection Agency. 1990b. Contract Laboratory Program Statements of Work for Organics. OLM01.0.

**NARRATIVE**

# DATA VALIDATION REPORT VOLATILE ORGANIC ANALYSES

## I. Sample Holding Times: ACCEPTABLE/With the following exceptions.

### Qualified Data:

Compound	Qualifier	Sample Number	Reason
All Volatile Compounds	J3(+)/UJ(-)	9205-049-7RE 9205-049-8RE	Holding times exceeded.

### Discussion

Samples 9205-049-7RE and 9205-049-8RE were analyzed to prove carry-over contamination in the initial results (see Section X). However, the samples were analyzed outside the holding time criterion of 14 days (for preserved water samples) by three days. Functional Guidelines recommends that if holding times are exceeded, any detected compounds are qualified as estimated (J3) and sample quantitation limits are estimated (UJ). All other samples were analyzed within the recommended holding time. Qualified data are summarized above.

## II. GC/MS Instrument Performance Check: ACCEPTABLE/All criteria met.

## III. Initial and Continuing Calibration: ACCEPTABLE/With the following exceptions.

### Qualified Data:

Compound	Qualifier	Sample Number	Reason
Acetone	J4(+)/UJ(-)	9205-049-1, 9205-049-2, 9205-049-3, 9205-049-4, 9205-049-5, 9205-049-6, 9205-049-7, 9205-049-8, 9205-049-9, 9205-049-10, 9205-049-11	Initial calibration %RSD >30%. %RSD=54.6%
Acetone	UJ(-)	9205-049-7RE, 9205-049-8RE	Continuing calibration %D >50%. %D = 62.8%
2-Butanone	UJ(-)	9205-049-7RE, 9205-049-8RE	Continuing calibration %D >50%. %D = 66.2%
2-Hexanone	UJ(-)	9205-049-7RE, 9205-049-8RE	Continuing calibration %D >50%. %D = 63.0%



## Discussion

The relative response factor (RRF) and the relative standard deviation (%RSD) for the initial calibration and the RRF and percent difference (%D) for the continuing calibration were evaluated. Criteria for %D and %RSD between calibrations were not met for compounds listed above. As stated in Functional Guidelines, positive results are estimated (J4), if initial calibration %RSD is greater than 30% and if %D for continuing calibration is greater than 25%. For significant %RSD or %D variations (>50%), detection limits are also qualified (UJ). Qualifiers are summarized in the above table.

### IV. Blank Analyses: ACCEPTABLE/With the following exceptions.

#### Qualified Data:

Compound	Qualifier	Sample Number	Reason
Methylene Chloride	UJ	9205-049-7, 9205-049-11, 9205-049-8RE	Sample concentration <10 times method blank concentration.
Hexane	R	9205-049-1, 9205-049-2, 9205-049-3, 9205-049-4, 9205-049-5, 9205-049-6, 9205-049-7, 9205-049-8, 9205-049-9, 9205-049-10, 9205-049-11	TIC found in the method blank and associated samples.

## Discussion

Methylene chloride, acetone and hexane were detected in the laboratory method blanks. Because methylene chloride and acetone are common laboratory contaminants, an action level is determined for data qualification at ten times the highest associated blank value. Because hexane is a tentatively identified compound (TIC), any detection in the associated samples are rejected (R). Qualified data are listed above.

A trip (Sample 9205-049-4) and rinsate (Sample 9205-049-9) blank were submitted for review. Hexane was detected in both the trip and rinsate blanks. Because hexane (a TIC) was found in the associated method blanks and hexane results are rejected in the associated samples, no qualifiers are required based on field blanks. Toluene was detected in the rinsate blank. Because no toluene was detected in the associated samples, no data are qualified.

### V. Surrogate Recovery: ACCEPTABLE/All criteria met.

VI. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Sample Analyses: ACCEPTABLE/All criteria met.

VII. Field Duplicates: ACCEPTABLE/With the following discussion.

Discussion

One set of field duplicates, Samples 9205-049-2/9205-049-3, were submitted for volatile analysis. Chloroform was detected in both samples at the same concentration resulting in a 0% Relative Percent Difference (RPD), indicating good field replication.

VIII. Internal Standards Performance: ACCEPTABLE/All criteria met.

IX. Compound Identification: ACCEPTABLE/All criteria met.

X. Compound Quantitation and Reported Contract Required Quantitation Limits (CRQL): ACCEPTABLE/With the following exceptions.

**Qualified Data:**

Compound	Qualifier	Sample Number	Reason
All Volatile Compounds	R	9205-049-7RE, 9205-049-8RE	Analyzed to support carry-over contamination claim. Use initial results.

Discussion

The laboratory's case narrative states that there was possible carry-over contamination from previous analyses to Samples 9205-049-7 and 9205-049-8. Reanalysis was performed (outside recommended holding time criteria) resulting in no carry-over compounds detected. Because the reanalyses were analyzed to confirm a carry-over contamination problem, initial analysis results are accepted and reanalysis results are rejected. The compounds were carry-over contamination and not in the sample, the contaminants were not reported on the initial analysis Form I. Qualified data are summarized above.

**XI. Tentatively Identified Compounds (TIC):** ACCEPTABLE/With the following discussion.

Discussion

All TIC results are flagged as tentatively identified compounds with estimated concentrations (JN).

**XII. System Performance:** ACCEPTABLE/All criteria met.

**XIII. Overall Assessment of the Data**

The data, as qualified, are acceptable for use.

# DATA VALIDATION REPORT SEMIVOLATILE ORGANICS ANALYSES

- I. Sample Holding Times: ACCEPTABLE\All criteria met.
- II. GC/MS Instrument Performance Checks: ACCEPTABLE\All criteria met.
- III. Initial and Continuing Calibration: ACCEPTABLE\With the following exceptions.

## Qualified Data:

Compound	Qualifier	Sample Number	%D	QC Criteria
Hexachlorocyclopentadiene	UJ	9205-049-1, 9205-049-2, 9205-049-3, 9205-049-6, 9205-049-7	+ 57.8%	Criteria limit $\leq$ 25% D

## Discussion

All of the relative response factors (RRF) were acceptable for all calibrations. All of the percent relative standard deviation (%RSD) in the initial calibration were below the control limit of 30% RSD. Several compounds in each of the continuing calibrations had percent difference (%D) values above the 25% upper control limit. There were no positive results for any of these compounds. For %D values that are high (above +50%) there is a possible loss of instrument sensitivity, affecting the quantitation limit. One compound had a %D value above 50% and is qualified as summarized in the above table.

- IV. Blank Analyses: ACCEPTABLE\With the following exceptions.

## Qualified Data:

Compound	Qualifier	Sample Number	Reason
TIC at RT= 6.50 TIC at RT= 8.97 TIC at RT=13.60 TIC at RT=14.22 TIC at RT=20.14	R	All samples	TIC detected in blank

# DATA VALIDATION REPORT SEMIVOLATILE ORGANICS ANALYSES

- I. Sample Holding Times: ACCEPTABLE\All criteria met.
- II. GC/MS Instrument Performance Checks: ACCEPTABLE\All criteria met.
- III. Initial and Continuing Calibration: ACCEPTABLE\With the following exceptions.

## Qualified Data:

Compound	Qualifier	Sample Number	%D	QC Criteria
Hexachlorocyclopentadiene	UJ	9205-049-1, 9205-049-2, 9205-049-3, 9205-049-6, 9205-049-7	+ 57.8%	Criteria limit $\leq$ 25% D

## Discussion

All of the relative response factors (RRF) were acceptable for all calibrations. All of the percent relative standard deviation (%RSD) in the initial calibration were below the control limit of 30% RSD. Several compounds in each of the continuing calibrations had percent difference (%D) values above the 25% upper control limit. There were no positive results for any of these compounds. For %D values that are high (above +50%) there is a possible loss of instrument sensitivity, affecting the quantitation limit. One compound had a %D value above 50% and is qualified as summarized in the above table.

- IV. Blank Analyses: ACCEPTABLE\With the following exceptions.

## Qualified Data:

Compound	Qualifier	Sample Number	Reason
TIC at RT= 6.50 TIC at RT= 8.97 TIC at RT=13.60 TIC at RT=14.22 TIC at RT=20.14	R	All samples	TIC detected in blank

## Discussion

The method blank associated with these samples was free of target compounds above the detection limit. Several unknown compounds were detected in the blank. As these compounds are present in the method blank and in all samples, the compounds are probably the result of laboratory contamination. For this reason, any unknown compound detected in a sample that is also present in the method blank is rejected (R).

V. **Surrogate Recovery:** ACCEPTABLE\With the following discussion.

## Discussion

Most of the reported surrogate recoveries did not agree with hand calculated results. The software used by the laboratory incorrectly used the sample volume when calculating surrogate recoveries. As the difference between the reported results and the true results is minor, no action was taken.

Several surrogates were reported that are outside the control limits. The hand calculated recoveries are acceptable. No qualifiers are required.

VI. **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Sample Analyses:** ACCEPTABLE\With the following exceptions.

**Qualified Data:** None

## Discussion

Analysis of MS/MSD samples was performed at the frequency of one set per twenty (or less) samples. All of the relative percent difference (RPD) values were within the specified control limits.

As discussed in Section V, the software used to generate the forms did not calculate the spike recoveries correctly. The sample volume was improperly used during the percent recovery calculations. All results were recalculated. The following compounds had percent recoveries above the specified control limits in both the MS and MSD samples: 4-nitrophenol, 2,4-dinitrotoluene and pentachlorophenol. There were no positive results for these compound in any of the samples. No data are qualified on the basis of MS/MSD results alone.

VII. **Field Duplicates:** ACCEPTABLE\All criteria met.

**VIII. Internal Standards Performance:** ACCEPTABLE\All criteria met.

**IX. Compound Identification:** ACCEPTABLE\All criteria met.

**X. Compound Quantitation and Reported Contract Required Quantitation Limits (CRQL):** ACCEPTABLE\With the following discussion.

Discussion

At least two compound or surrogate quantitations per analysis were reviewed, and all reviewed compound quantitations were performed correctly, and all others are assumed to be correct.

The CLP SOW requires that semi-volatile compounds use a CRQL base of 10 ppb for most compounds and 50 ppb for eight compounds for quantitation limit calculations. These numbers are adjusted to reflect sample matrix, size, moisture factors and dilutions. All CRQL calculations in the data package assume a base of 10 ppb and 25 ppb. As there were no positive results for the compounds with the incorrect CRQL, and as the reported CRQL is lower than the CLP CRQL, no action was taken. All CRQL were adjusted correctly for sample size and dilution factors.

**XI. Tentatively Identified Compounds (TIC):** ACCEPTABLE\With the following discussion.

Discussion

The results of mass spectral library searches to identify TIC were reviewed. As discussed in Section IV, any TIC in a sample that was also detected in the method blank is assumed to be the result of laboratory contamination and is rejected. All other TIC results are acceptable.

**XII. System Performance:** ACCEPTABLE\All criteria met.

**XIII. Overall Assessment of the Data**

Data, as qualified, are acceptable for use.

**DATA VALIDATION REPORT  
PESTICIDE/PCB ANALYSES**

- I. **Sample Holding Times:** ACCEPTABLE/All criteria met.
- II. **Instrument Performance:** ACCEPTABLE/All criteria met.
- III. **Calibration:** ACCEPTABLE/With the following discussion.

Discussion

The percent relative standard deviation (%RSD) for dibutylchlorendate (DBC) for the DB-1701 (confirmation) column was 10.6%. The 10.0% RSD criterion is not required to be met for the confirmation column and no action was required.

One calibration factor for aldrin was transcribed incorrectly as 2610000 on Form VIII PEST-1 for the DB-1701 column. The correct value was 3610000. The %RSD value reported, 8.4%, was correct. No qualifications of data are recommended based on calibration information.

- IV. **Blank Analyses:** ACCEPTABLE/All criteria met.
- V. **Surrogate Recovery:** ACCEPTABLE/All criteria met.
- VI. **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Sample Analyses:** ACCEPTABLE/All criteria met.
- VII. **Field Duplicates:** ACCEPTABLE/All criteria met.

One pair of field duplicates was submitted. No positive identifications were made in either sample.

- VIII. **Compound Identification:** ACCEPTABLE/All criteria met.



**IX. Compound Quantitation and Contract Required Quantitation Limits (CRQL):**  
ACCEPTABLE/All criteria met.

**X. Overall Assessment of the Data**

The laboratory performed the pesticide/PCB analyses within method specifications. All contract criteria were met. The data, as reported, are acceptable for use.

**DATA VALIDATION REPORT  
POLYNUCLEAR AROMATIC HYDROCARBON ANALYSES**

- I. Sample Holding Times: ACCEPTABLE/All criteria met.**
- II. Instrument Performance: ACCEPTABLE/All criteria met.**
- III. Calibration: ACCEPTABLE/With the following discussion.**

Discussion

Several compounds failed to meet the 15.0% QC limit for continuing calibration for the primary analysis. Exceeded values ranged from 16-18%. No compounds were positively identified in any samples associated with this data group. No qualifications of data are recommended based on calibration information.

- IV. Blank Analyses: ACCEPTABLE/All criteria met.**
- V. Surrogate Recovery: ACCEPTABLE/All criteria met.**
- VI. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Sample Analyses: ACCEPTABLE/All criteria met.**
- VII. Field Duplicates: ACCEPTABLE/All criteria met.**

One pair of field duplicates was submitted. No positive identifications were made in either sample.
- VIII. Compound Identification: ACCEPTABLE/All criteria met.**
- IX. Compound Quantitation and Contract Required Quantitation Limits (CRQL): ACCEPTABLE/All criteria met.**

## **X. Overall Assessment of the Data**

Generally, the laboratory performed the PAH analyses within method specifications. Those problems found have been noted in this report. The data, as reported, are acceptable for use.

**DATA VALIDATION REPORT**  
**TOTAL METALS, LOW LEVEL COPPER, BORON AND CYANIDE ANALYSES**

- I.     **Sample Holding Times:** ACCEPTABLE/All criteria met.
- II.    **Instrument Calibration:** ACCEPTABLE/All criteria met.
- III.   **Blank Analyses:** ACCEPTABLE/With the following exceptions.

**Qualified Data:**

Analyte	Qualifier	Sample Number	Reason
Boron	UJ	W24336, W24339, W24340	The sample concentration was within five times the PB concentration.
Cadmium	UJ	W24339, W24341	The sample concentration was within five times the PB concentration.
Zinc	UJ	W24337, W24339, W24340, W24341, W24342, W24344	The sample concentration was within five times the PB concentration.

Discussion

Three types of blanks are evaluated for possible contamination affects. These blanks are: calibration blanks (ICB and CCB), preparation blanks (PB), and field QC blanks.

For all laboratory blanks, both positive and negative blank values were evaluated, and an action limit of five times the highest associated blank concentration was determined for each affected analyte. For analytes with positive blank values, if the sample result was less than the action limit, it should be considered undetected at the reported concentration and assigned a UJ qualifier. No data qualifiers are required for undetected sample results. For analytes with negative blank values, the raw data were reviewed, and each sample raw data result was checked to see if a possible false negative or biased sample result was reported. Samples to be qualified, based on this review, are summarized in the above table.

One field blank was submitted for analysis. Boron, cadmium, lead, sodium, and zinc were found in the field blank. Zinc was detected at a concentration greater than the CRDL. No data qualification of the samples will be made based on the field blank results. However, consideration of the field blank contamination above the CRDL should be made when evaluating the data.

Other analytes may have reported positive or negative blanks for the ICB, CCB, PB, and field QC blanks but either the sample results were undetected, greater than the action limit, or upon review of the raw data, were not affected by the associated blank value.

IV. ICP Interference Check Sample (ICS) Analyses: ACCEPTABLE/All criteria met.

V. Laboratory Control Sample (LCS) Analyses: ACCEPTABLE/All criteria met.

VI. Duplicate Sample Analyses: ACCEPTABLE/With the following exceptions.

**Qualified Data:**

Analyte	Qualifier	Sample Number	Reason
Iron	UJ(-) J4(+)	W24336, W24337, W24338, W24339, W24340, W24341, W24342, W24343, W24344, W24345	The RPD (21.2%) between duplicate sample results was outside the control limits (RPD < 20%, or $\pm$ CRDL).
Zinc	UJ(-) J4(+)	W24336, W24337, W24338, W24339, W24340, W24341, W24342, W24343, W24344, W24345	The RPD (92.9%) between duplicate sample results was outside the control limits (RPD < 20%, or $\pm$ CRDL).

Discussion

The duplicate results for all analytes, except iron and zinc, were within the water control limits. For water duplicate results, the relative percent difference (RPD) must be less than 20%, or the duplicate results must agree within  $\pm$  CRDL. The laboratory flagged calcium and sodium as outside the control limits. The RPD for both analytes were 0.7%. No data qualifications are required for calcium and sodium. Samples to be qualified are summarized in the above table.

**VII. Spiked Sample Analyses: ACCEPTABLE/With the following exceptions.**

**Qualified Data:**

Analyte	Qualifier	Sample Number	Reason
Lead	J4(+)	W24337, W24338, W24339, W24340, W24341, W24342, W24343, W24344, W24345	The percent recovery of the MS was greater than 125% (133%).
Selenium	UJ(-) J4(+)	W24336, W24337, W24338, W24339, W24340, W24341, W24342, W24343, W24344, W24345	The percent recovery of the MS was between 30 - 74% (70%).

Discussion

Matrix spike (MS) percent recoveries were within the control limits, except MS recoveries for lead and selenium. Sample qualifications were determined following the guidelines specified in the 1988 Inorganics Functional Guidelines. Samples to be qualified are summarized in the above table.

**VIII. Furnace AA Quality Control Analyses: ACCEPTABLE/With the following exceptions.**

**Qualified Data:**

Analyte	Qualifier	Sample Number	Reason
Copper	J4	W24338, W24339, W24340, W24341, W24342, W24344	The post spike percent recoveries were less than 85% (69% - 79%).
Lead	J4	W24338, W24341, W24343, W24344	The post spike percent recoveries were greater than 115% (134% - 196%).

Discussion

The laboratory is required to perform a post digestion spike on each analyte analyzed by graphite furnace (GFA). The percent recovery control limits of the post spike is 85 - 115%. If sample post spike recoveries fall outside the control limits, matrix interferences (positive or negative) may be present. If the sample result is less than 50% of the post spike concentration and the percent recovery is greater than 40%, no further action is required by the laboratory, but the laboratory must flag the data with a W. The W flag is required for all samples summarized in the table below.

If the sample absorbance is greater than 50% of the post spike concentration and the percent recovery is outside the control limits, the laboratory is required to analyze the sample by methods of standard additions (MSA). The laboratory did perform the MSA analyses when required. All samples analyzed by MSA had correlation coefficients within the control limit ( $>0.995$ ).

Under the 1988 Inorganic Functional Guidelines, samples with post spike recoveries outside the control limits (85-115%) are to be qualified as estimates. However, review of the data indicated that no sample, where the post spike recovery was outside the control limits, had results detected above the CRDL, except six samples for copper (CRDL = 1.0 ug/L) and four samples for lead (CRDL = 3.0 ug/L). It is recommended that only those samples with analyte concentrations greater than the CRDL be qualified. Therefore, data qualifiers are recommended for the copper and lead results summarized in the above table.

Samples Requiring the W Qualifier				
Arsenic	Copper	Lead	Selenium	Thallium
None	W24337, W24338, W24339, W24340, W24341, W24342, W24344	W24336, W24337, W24338, W24339, W24340, W24341, W24342, W24343, W24344	W24336, W24337, W24338, W24339, W24340, W24341, W24342, W24343, W24344, W24345	None

IX. ICP Serial Dilution Analyses: ACCEPTABLE/All criteria met.

X. Sample Result Verification: ACCEPTABLE/With the following discussion.

#### Discussion

The sample and QC results were verified at a minimum of ten percent. No data calculation errors were found.

The following transcription errors were noted:

(1) A lab sample identification number was entered incorrectly for sample 1773GU000000027.000. The correct lab sample ID number should be W24336.

(2) Undetected duplicate results were entered on Form 6 (Duplicates) as undetected at a concentration less than the IDL.

(3) The calcium and sodium results erroneously were qualified based on duplicate results. Review of the raw data indicated the results reported were correct, and the RPD values reported were 0.7% for both calcium and sodium.

The laboratory was contacted and corrected forms were submitted.

**XI. Field Quality Controls: ACCEPTABLE/With the following discussion.**

Discussion

One field duplicate sample was submitted to the laboratory for analysis. All analyte duplicate results were within the control limits (RPD < 20%, or  $\pm$  CRDL), except zinc (RPD = 129%). Zinc results have been previously qualified due to laboratory duplicate results.

**XII. Quarterly Submissions: ACCEPTABLE/All criteria met.**

**XIII. Overall Assessment of Data:**

The overall data quality was good. Samples were qualified for blank contamination, duplicate and matrix spike results. Zinc was detected in the field blank at a concentration greater than the CRDL. The laboratory field duplicate results for zinc also exceeded the control limits. This may be a result of introduction of zinc during field or laboratory procedures.



**DATA VALIDATION REPORT  
TOTAL PETROLEUM HYDROCARBON ANALYSIS**

**I. Sample Holding Times: ACCEPTABLE/All criteria met.**

Samples were analyzed within the recommended holding time of 28 days.

**II. Instrument Calibration: ACCEPTABLE/All criteria met.**

The instrument was calibrated using a blank and four standards as described in the method.

**III. Blank Analyses: ACCEPTABLE/All criteria met.**

No contamination was found in the blanks.

**IV. Laboratory Control Sample: ACCEPTABLE/All criteria met.**

The laboratory analyzed a blank spike and a blank spike duplicate. The percent recoveries were 65% and 66%, with an RPD of 2%.

**V. Duplicate Sample Analyses: ACCEPTABLE/All criteria met.**

The laboratory analyzed one duplicate sample. The duplicate analyses were both undetected for TPH, therefore the RPD was not calculated.

**VI. Spike Sample Analyses: ACCEPTABLE/All criteria met.**

The laboratory analyzed one matrix spike and a matrix spike duplicate. The percent recoveries were 77% and 80%, with an RPD of 4%.

**VII. Sample Result Verification: ACCEPTABLE/All criteria met.**

**VIII. Field Quality Controls: ACCEPTABLE/All criteria met.**

One field duplicate sample was submitted for analysis. Both samples were undetected for TPH, therefore the RPD was not calculated.

**IX. Overall Assessment of Data:**

The overall data quality was good. The percent recoveries of the blank spikes were slightly low but because the matrix spike results were good, no data were qualified.

**DATA VALIDATION REPORT  
TOTAL DISSOLVED SOLIDS (TDS) AND  
TOTAL SUSPENDED SOLIDS (TSS) ANALYSIS**

**I. Sample Holding Times: ACCEPTABLE/All criteria met.**

Samples were analyzed within the recommended holding time of 7 days.

**II. Blank Analyses: ACCEPTABLE/With the following discussion.**

Discussion

No contamination was found in the blank associated with the TSS. Blank contamination was found in the TDS blank at the method detection limit. All sample results, except the field blank, had TDS concentrations greater than ten times the blank concentration. No data qualifications are recommended.

No contamination was found in the field blank for TSS. The field blank had a TDS concentration of 27 mg/L. No data qualifications are recommended based on the field blank, but should be considered when interpreting TDS results.

**III. Laboratory Control Sample: Not Applicable.**

No laboratory control sample was analyzed with the samples.

**IV. Duplicate Sample Analyses: ACCEPTABLE/All criteria met.**

The laboratory analyzed one duplicate sample for TDS and TSS. The relative percent difference (RPD) between TDS results was zero, and RPD was not calculated for TSS due to undetected sample results for TSS.

**V. Spike Sample Analyses: Not Applicable.**

**VI. Sample Result Verification: ACCEPTABLE/All criteria met.**

**VII. Field Quality Controls: ACCEPTABLE/All criteria met.**

One field duplicate sample was submitted for analysis. For the TDS analysis the RPD was 12.5%, and for the TSS analysis the RPD was 5.4%, indicating good precision.

**VIII. Overall Assessment of Data:**

The data quality was good. No data were qualified.

**PRODUCT AND SOIL VAIDATION REPORT**

**DATA VALIDATION REPORT**

**Amsted Subsurface Investigation**

**Prepared for:**

**Kennedy/Jenks Consultants  
530 South 336th Street  
Federal Way, Wa. 98003**

**Prepared by:**

**EcoChem, Inc.  
911 Western Avenue  
Suite 523  
Seattle, WA 98104**

**EcoChem Contract: 2306**

**June 12, 1992**

**Amsted Subsurface Investigation**

**CONTRACT LABORATORIES:**

**Volatile, Semivolatile Organics, Pesticides/PCBs,  
Polynuclear Aromatic Hydrocarbons:**  
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**DATA VALIDATION**  
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## INTRODUCTION

The submitted data packages have been reviewed by EcoChem, Inc. Data validation packets for the organics and inorganics analyses, which detail items reviewed, are on file at EcoChem. The quality assurance evaluations performed and the resulting data qualification recommendations are summarized in the following sections:

- Volatile Organic Analyses
- Semivolatile Organic Analyses
- Pesticide/PCB Analyses
- PAH Analyses
- Total Metals Analyses

Recommended data qualifiers are based on the EPA Data Validation Functional Guidelines (U.S. EPA, 1988b, c, d). These guidelines require that the data reviewer use professional judgment to designate data qualifiers, but do not replace those assigned by the laboratory. Data may be qualified even though the laboratory fulfilled all the requirements stated in the EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for a particular analysis (U.S. EPA, 1988a, 1990a, b). Unless specifically stated in the text, data qualifications are not due to laboratory error or deviations from the analysis protocols defined in the EPA SOW, but are based on EPA data validation guidelines.

EcoChem, Inc.'s goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are assigned a J, or UJ, data can be used for site evaluation purposes, but reasons for data qualification should be taken into consideration when interpreting sample concentrations. If values are assigned an R, the data are to be rejected and should not be used for any site evaluation purposes. If values have no data qualifier assigned, then the data meet all data quality goals as outlined in the EPA Functional Guidelines and as required by the South Tacoma Field Superfund Site Quality Assurance Project Plan, March, 1991.

Holding times, sample integrity and required analyses were determined by review of the chain-of-custody sheets. Chain-of-custody records were received for all samples. A summary of the samples reviewed is provided in Table 1.



**Table 1. Summary of Analysis Reviewed.**

Sample Number	VOA	BNA	Pest/ PCBs	Metals	PAH
1774PP000000000.000	2/27 01140"	2/27 01140"	2/27 01110"	2/27 01140"	2/27 01140"
1790SB310000024.001	5/11 03112V	5/11 03112		5/11 JOB303	
1791SB310000027.000	5/11 03205	5/11 03112		5/11 JOB303	
1794SB310000029.500	5/11 03205	5/11 03112		5/11 JOB303	

**KEY**

VOA	=	CLP Volatile Organic Compounds
BNA	=	Base/Neutral/Acid (Semivolatile) Compounds
P/PCB	=	TCL Pesticide Compounds and Polychlorinated Biphenyls Pesticides
Metals	=	TCL Metals
PAH	=	Polynuclear Aromatic Hydrocarbon

**Note:** If numbers noted in box, then sample results were reviewed. The first line in the box is the date sample results were received at EcoChem. The second line is the EcoChem sampling data group number used for file tracking purposes.

## REFERENCES

Kennedy/Jenks/Chilton. 1991. Quality Assurance Project Plan South Tacoma Field Superfund Site, Tacoma, Wa. March.

U.S. Environmental Protection Agency. 1988a. Contract Laboratory Program Statement of Work for Pesticides/PCBs.

U.S. Environmental Protection Agency. 1988b. Functional Guidelines for Evaluating Inorganic Analyses.

U.S. Environmental Protection Agency. 1988c. Functional Guidelines for Evaluating Organic Analyses. R-582-5-5-01.

U.S. Environmental Protection Agency. 1988d. Functional Guidelines for Evaluating Pesticide/PCB Analyses. R-582-5-5-01.

U. S. Environmental Protection Agency. 1990a. Contract Laboratory Program Statements of Work for Inorganics. ILM01.0.

U. S. Environmental Protection Agency. 1990b. Contract Laboratory Program Statements of Work for Organics. OLM01.0.

**NARRATIVE**

**DATA VALIDATION REPORT  
VOLATILE ORGANIC ANALYSES**

- I. Sample Holding Times: ACCEPTABLE/All criteria met.
- II. GC/MS Instrument Performance Check: ACCEPTABLE/All criteria met.
- III. Initial and Continuing Calibration: ACCEPTABLE/With the following exceptions.

**Qualified Data:**

Compound	Qualifier	Sample Number	Reason
Methylene Chloride	J4(+)	9203-205-1, 9203-205-2	Continuing calibration %D > 25%. (%D = 47.6%)
Methylene Chloride	J4(+)	9203-112-1	Continuing calibration %D > 25%. (%D = 35.0%)
Acetone	J4(+)	9203-205-1, 9203-205-2, 9203-112-1	Initial calibration %RSD > 30%. (%RSD = 44.2%)
2-Butanone	R(-)	9201-140-1, 9201-140-1DUP	Continuing calibration RRF50 < 0.05. (RRF50 = 0.041)

**Discussion**

The relative response factor (RRF) and the percent relative standard deviation (%RSD) for the initial calibration, and the RRF and percent difference (%D) for the calibration were evaluated. The five point calibration curve was established using different concentrations of standards for SDG 01140 than stated in the 1990 SOW. The laboratory analyzed the standards at the concentrations specified by the 1988 SOW. This was judged not to affect the results, and no qualifiers are recommended.

Criteria for %D, RRF50 and %RSD between calibrations were not met for compounds listed above. Functional Guidelines specifies positive results are assigned a J4 qualifier if initial calibration RSD is greater than 30%, and if %D for continuing calibration is greater than 25%. For significant %RSD of %D variations (>50%), detection limits are

also qualified (UJ). If the RRF is less than 0.05, then positive results are qualified as estimated (J4) and nondetects unusable (R). Qualifiers are summarized in the above table.

**IV. Blank Analyses: ACCEPTABLE/With the following exceptions.**

**Qualified Data:**

Compound	Qualifier	Sample Number	Reason
Methylene Chloride	UJ at Reported Value	9203-205-1, 9203-205-2, 9203-112-1, 9201-140-1DUP	Sample value < 10 x method blank concentration.
Acetone	UJ at Reported Value	9203-205-1, 9203-205-2, 9203-112-1, 9201-140-1, 9201-140-1DUP	Sample value < 10 x method blank concentration.

Discussion

Methylene chloride and acetone were detected in the laboratory method blanks. Because these are common laboratory contaminants, an action level is determined for data qualification at 10 times the highest associated blank value. Samples with concentrations less than the action level are qualified (UJ), and are listed in the above table.

The laboratory did not follow the CLP SOW for blank analyses, as method blank weights did not always match the associated sample weight. Therefore, to compare method blank results to sample results, results from the raw data instrument readouts were used, rather than Form I results.

**V. Surrogate Recovery: ACCEPTABLE/With the following exceptions.**

**Qualified Data:**

Compound	Qualifier	Sample Number	Reason
All volatile organic compounds	R	9201-140-1	Low surrogate recovery. Use duplicate results.

Discussion

Surrogate percent recovery (%R) for toluene-d8 was low (76%) for Sample 9201-140-1 indicating possible low biased results. A duplicate sample was analyzed with results within

control limits. It is recommended that the sample results for 9201-140-1 be rejected and the 9201-140-1DUP results be used instead.

VI. Matrix Spike/Matrix Spike Duplicate Sample Analyses: ACCEPTABLE/All criteria met.

VII. Field Duplicates: Not Submitted.

#### Discussion

A field duplicate was not submitted, but the laboratory performed the product sample analysis in duplicate. Surrogate recovery was low for one analyses (9201-140-1), and relative percent differences (RPD) between the duplicates were high (12.5%-86.7%). Therefore, the results reported for Sample 9201-140-1DUP are recommended to be used rather than the initial results which may be biased low.

VIII. Internal Standards Performance: ACCEPTABLE/All criteria met.

IX. Compound Identification: ACCEPTABLE/All criteria met.

X. Compound Quantitation and Reported Contract Required Quantitation Limits (CRQL): ACCEPTABLE/All criteria met.

XI. Tentatively Identified Compounds (TIC): ACCEPTABLE/With the following exceptions.

#### Discussion

All TIC are flagged tentatively identified at estimated concentrations (JN).

XII. System Performance: ACCEPTABLE/All criteria met.

XIII. Overall Assessment of the Data

The data, as qualified, are acceptable for use.

**DATA VALIDATION REPORT  
SEMIVOLATILE ORGANICS ANALYSES**

I. Sample Holding Times: ACCEPTABLE\With the following exceptions.

Qualified Data: None

Discussion

The holding time criterion of fourteen days from date of sampling was used for soils and the product sample. The matrix spike duplicate associated with the soil samples was extracted 17 days after sampling. All other MS/MSD QC parameters (surrogates, percent recovery, and RPD values) were acceptable, so no action was taken. All analyses met the 40 days from date of extraction holding time criterion.

II. GC/MS Instrument Performance Checks: ACCEPTABLE\All criteria met.

III. Initial and Continuing Calibration: ACCEPTABLE\With the following exceptions.

Qualified Data:

Compound	Qualifier	Sample Number	%D or RRF	QC Criteria
Hexachlorocyclo pentadiene	UJ	9203-205-1	+74.1	Criteria limit $\leq$ 25%D
2,4-Dinitrophenol	UJ	9203-205-1	+66.2	Criteria limit $\leq$ 25%D
4-Chloroaniline	UJ	9203-205-2	+66.4	Criteria limit $\leq$ 25%D
Hexachlorocyclo pentadiene	UJ	9203-205-2	+67.0	Criteria limit $\leq$ 25%D
4-Nitroaniline	UJ	9203-205-2	+65.4	Criteria limit $\leq$ 25%D
4,6-Dinitro-2-Methylphenol	UJ	9203-205-2	+64.9	Criteria limit $\leq$ 25%D
2-Nitroaniline	R	9203-205-2	0.044	Criteria limit $\geq$ 0.050 RRF.

2,4-Dinitro-phenol	R	9203-205-2	0.040	Criteria limit $\geq$ 0.050 RRF.
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#### Discussion

Each of the three initial calibrations had several compounds that exceeded the 30% limit for percent Relative Standard Deviation (%RSD). These compounds were not detected in any of the samples. The slightly high %RSD were judged not to affect the quantitation limits and no data qualifiers are recommended.

Each of the continuing calibrations had several compounds that exceeded the 25% limit for percent difference. While none of these compounds were detected in the samples, the high percent differences for some of the compounds demonstrated a possible loss of sensitivity for that compound, affecting the quantitation limit. These compound quantitation limits are estimated (UJ) in the associated samples, and are listed in the above table.

Two compounds in the 4/16/92 continuing calibration (3-nitroaniline and 2,4-dinitrophenol) had relative response factors (RRF) that were below the 0.05 lower acceptance threshold. There were no positive results for these compounds. The non-detects are rejected (R) due to loss of sensitivity, and are listed in the above table.

The Form 7 (continuing calibration report) submitted with the product sample data package had many errors in the "Minimum RRF" column. The RRF printed on the form did not match the RRF specified in the 3/90 SOW. Data were validated on the basis of the correct RRF from the 3/90 SOW, and all RRF results were acceptable.

The RRF for 2,4,6-tribromophenol in the soil samples was not updated. The incorrect RRF was used to calculate the detected concentration of 2,4,6-tribromophenol, which in turn invalidated all percent recoveries reported for this surrogate. As the qualifiers applied to the samples would not change on the basis of this one surrogate, no action was taken. See Section V.

#### IV. Blank Analyses: ACCEPTABLE\With the following exceptions.

##### Qualified Data:

Compound	Qualifier	Sample Number	Reason
Di-n-butylphthalate Bis(2-ethylhexyl) phthalate	UJ at Reported Value	9203-205-1	Sample within 10x method blank concentration.



Bis(2-ethylhexyl) phthalate	UJ at Reported Value	9203-205-2	Sample within 10x method blank concentration.
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### Discussion

The method blank associated with the product sample was free of target compounds above the detection limit. Each of the soil method blanks contained di-n-butylphthalate and bis (2-ethylhexyl) phthalate. SBLKA327 also contained butylbenzylphthalate. Only the matrix spike was associated with SBLKA327, and matrix spike samples are not qualified due to blank contamination. The 'ten times' rule from Functional Guidelines was used to qualify the phthalate contamination in SBLK0324. The data qualifiers are summarized in the above table.

V. Surrogate Recovery: ACCEPTABLE\With the following exceptions.

### **Qualified Data:**

Compound	Qualifier	Sample Number	Reason
All positive results	J4	9201-140-1	4 surrogate recoveries above limits.
All positive results	J4	9201-140-1RE	4 surrogate recoveries above limits.
All results	R	9201-140-1A	Use results from reanalysis 9201-140-1ARE.

### Discussion

For the soil samples, one analysis 9203-205-2 had a recovery for 2-fluorobiphenyl that was above the acceptance limits. All other soil surrogate recoveries were acceptable, so no soil samples were qualified due to surrogates.

For the product sample, the analysis and reanalysis at the highest concentration (5 fold dilution) each had four surrogates (2-fluorobiphenyl, terphenyl-d14, phenol-d5 and 2,4,6-tribromophenol) with percent recoveries above the acceptance limits. All positive results in those analyses are estimated (J). Functional Guidelines does not recommend qualifiers for non-detects when surrogate recoveries are high.

A 20-fold dilution and reanalysis was performed on the product sample. The dilution had three surrogates (nitrobenzene-d5, 2-fluorobiphenyl and phenol-d5) above the

acceptance limits. The reanalysis of the dilution had only phenol-d5 above the acceptance limits. The precision between the two analyses was acceptable, with the highest relative percent difference (RPD) value at 24%. For these reasons, all results from the initial 20-fold dilution are rejected (R), and the results from the reanalysis should be used.

The two additional surrogates required by the 3/90 SOW (2-chlorophenol-d4 and 1,2-dichlorobenzene-d4) were not added to the product analyses. This is a contractual violation rather than a technical one, and no data were qualified due to this problem.

Due to the software used by the laboratory most surrogate recovery results did not agree with hand calculations. This was determined to be caused by rounding performed by the software. Some of these differences resulted in surrogate recoveries being reported as acceptable when calculated results without rounding were above the control criteria. All of the 2,4,6-tribromophenol results were incorrectly calculated, as the incorrect RRF factor was used (see also Section III). Data are validated on the basis of the correct results calculated from the raw data. The laboratory was requested to submit corrected data forms.

VI. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Sample Analyses:  
ACCEPTABLE\With the following exceptions.

Qualified Data: None.

#### Discussion

For the product sample, a MS/MSD set was analyzed at the high concentration (5-fold dilution) and the 20-fold dilution level. A blank spike MS/MSD was also analyzed. At the 5-fold dilution level, all percent recoveries except 2,4-dinitrotoluene in the MSD sample were above the specified control limits. In the 20-fold dilution MS/MSD, all percent recoveries were above the limits. In the blank spike MS/MSD, 11 of 22 compounds had percent recoveries above the acceptance limits. All of the RPD values were acceptable except for the RPD for phenol in the 20-fold dilution MS/MSD.

One explanation for the high recoveries is matrix effects. Other QC criteria such as surrogate and internal standard recoveries demonstrate that there is a matrix effect, especially in the 5-fold dilution. Another possible explanation is that the (on-column) level of analytes detected is 20 ug/Kg, which is the same level as the lowest calibration standard. The five point curve tends to give slightly higher variations in concentration results at the lowest (20 ug/Kg) and highest (160 ug/Kg) points in the curve. The 20 ug/Kg standard in the initial calibration also gave somewhat higher results than did the other concentrations.

In the soil samples MS/MSD set, all percent recoveries were acceptable. One RPD value (n-nitroso-di-n-propylamine at 47) was above the acceptance limit. No data are qualified on the basis of MS/MSD results alone.

## VII. Field Duplicates: Not Submitted.

### Discussion

A field duplicate was not submitted, but the laboratory performed the product sample analysis in duplicate. The results of the duplicates were compared. The highest RPD value was 24.6, which indicates an acceptable level of precision.

## VIII. Internal Standards Performance: ACCEPTABLE\With the following exceptions.

### Qualified Data:

Compound	Qualifier	Sample Number	Reason
4,6-Dinitro-2-methyl- phenol N-nitrosodiphenylamine 4-Bromophenylphenylether Hexachlorobenzene Pentachlorophenol Phenanthrene Carbazole Anthracene Di-n-butylphthalate Fluoranthene Pyrene Butylbenzylphthalate 3,3'-Dichlorobenzidine Benzo(a)anthracene bis-2-(ethylhexyl)phthalate Chrysene Di-n-octylphthalate Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	UJ(-) J4(+)	9201-140-1	Area count of IS < 50% of continuing calibration IS.

Compound	Qualifier	Sample Number	Reason
Hexachlorocyclopentadiene 2,4,6-Trichlorophenol 2,4,5-Trichlorophenol 2-Chloronaphthalene 2- Nitroaniline Dimethylphthalate Acenaphthylene 3-Nitroaniline Acenaphthene 2,4-Dinitrophenol 4-Nitrophenol Dibenzofuran 2,4-Dinitrotoluene 2,6-Dinitrotoluene Diethylphthalate 4-Chlorophenylphenylether Fluorene 4-Nitroaniline 4,6-Dinitro-2-methylphenol N-nitrosodiphenylamine 4-Bromophenylphenylether Hexachlorobenzene Pentachlorophenol Phenanthrene Carbazole Anthracene Di-n-butylphthalate Fluoranthene Pyrene Butylbenzylphthalate 3,3'-Dichlorobenzidine Benzo(a)anthracene bis-2-(ethylhexyl)phthalate Chrysene Di-n-octylphthalate Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	J4(+)/ UJ(-)	9201-140-1RE	Area count of IS < 50% of continuing calibration IS.

### Discussion

For the soil samples, the internal standard (IS) areas and retention times met all the required QC criteria.

For the product analyses, all internal standard retention times were acceptable. All analyses at the 5-fold dilution level (original, reanalysis, MS, MSD) showed a matrix effect that caused the internal standard area to fall below the acceptance limit of 50% the internal standard area found in the continuing calibration standard. All compounds associated with the internal standards with low recoveries are estimated, with positive results J flagged and negative results (non-detects) UJ flagged.

**IX. Compound Identification:** ACCEPTABLE/All criteria met.

**X. Compound Quantitation and Reported Contract Required Quantitation Limits (CRQLs):** ACCEPTABLE\With the following discussion.

Discussion

At least two compound quantitations per analysis were reviewed, and with the exception of 2,4,6-tribromophenol (as discussed in Section III), all reviewed compound quantitations were performed correctly and all others are assumed to be correct.

The CLP SOW requires that semi-volatile compounds use a CRQL base of 10 ppb for most compounds and 50 ppb for eight compounds for quantitation limit calculations. These numbers are adjusted to reflect sample matrix, size, moisture factors and dilutions. All CRQL calculations in the reviewed data packages assume a base of 10 ppb and 25 ppb. As there were no positive results for the compounds with incorrect CRQL, and as the reported CRQL are lower than the CLP CRQL, no action was taken. All CRQL were correctly adjusted for sample size, dilution factors and moisture correction factors.

**XI. Tentatively Identified Compounds (TIC):** ACCEPTABLE\With the following exceptions.

**Qualified Data:**

Sample Number	Retention Time	Compound Identification	Corrected Compound Identification	C.A.S.
9203-112-1	15.72	Unknown Hydrocarbon	1H-Indene, 2,3-dihydro-1-methyl (or isomer)	767588
9203-112-1	18.35	Unknown Hydrocarbon	Unknown aromatic	-
9203-112-1	20.50	Unknown Hydrocarbon	Naphthalene, 1-ethyl-	1127760

9203-112-1	21.32	Unknown Hydrocarbon	Naphthalene, 1,4-dimethyl (or isomer)	571584
9203-112-1	23.17	Unknown Hydrocarbon	Naphthalene, 2,3,6-trimethyl (or isomer)	829265

### Discussion

The results of mass spectral library searches to identify TIC were reviewed. With the exception of the above noted compounds for sample 9203-112-1, all TIC results are acceptable. The above noted changes give more specific identifications for generically identified TIC. It should also be noted that any reported compound that exists in several possible forms (such as 1,7-dimethyl naphthalene and 1,2-dimethyl naphthalene) should always be identified with the proviso "or isomer" unless the isomer specific retention times are known.

**XII. System Performance:** ACCEPTABLE\All criteria met.

**XIII. Overall Assessment of the Data:**

Most of the qualifiers applied to the product analyses are due to matrix effects, as demonstrated by the reanalyses and the subsequent dilutions and reanalyses. The most accurate results are from the reanalysis of the 20-fold dilution. The data from the five-fold dilution are best used to set lower detection limits. With a few exceptions due to calibration drift (as summarized in the table in Section III), the soil analyses are acceptable as reported by the lab.

**DATA VALIDATION REPORT  
PESTICIDE/PCB ANALYSES**

- I. **Sample Holding Times:** ACCEPTABLE/All criteria met.
- II. **Instrument Performance:** ACCEPTABLE/With the following exceptions.

**Qualified Data:** None

Discussion

Several compounds failed to elute within their established retention time windows for some of the continuing calibration standards. Adjusted/expanded RT windows were employed to ensure that no false identifications were made. None were found and no qualifications of data are recommended.

- III. **Calibration:** ACCEPTABLE/With the following exceptions.

**Qualified Data:** None

Discussion

Several compounds failed to meet continuing calibration criteria. No out-of-control standards were used for quantitation and no qualifications of data are recommended.

- IV. **Blank Analyses:** ACCEPTABLE/All criteria met.
- V. **Surrogate Recovery:** ACCEPTABLE/All criteria met.
- VI. **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Sample Analyses:**  
ACCEPTABLE/With the following exceptions.

**Qualified Data:**

Compound	Qualifier	Sample Number	Reason
Gamma-BHC Aldrin Endrin	UJ	9201-140-1	Low MS/MSD recoveries. (28-40%)

Discussion

MS/MSD recoveries were low for three spiked compounds. Results for these three compounds have been qualified as estimated as shown in the table above.

**VII. Field Duplicates: Not Submitted.**

Discussion

A field duplicate was not submitted, but the laboratory performed the product sample analysis in duplicate. No pesticides or PCBs were detected in either analyses.

**VIII. Compound Identification: ACCEPTABLE/All criteria met.**

**IX. Compound Quantitation and Contract Required Quantitation Limits (CRQLs):  
ACCEPTABLE/All criteria met.**

**X. Overall Assessment of the Data**

Generally, the laboratory performed the pesticide/PCB analysis within contract specifications. A few problems were found and have been noted in this report. The data, as qualified, are acceptable for use.



**DATA VALIDATION REPORT  
POLYNUCLEAR AROMATIC HYDROCARBON ANALYSES**

- I.     **Sample Holding Times:** ACCEPTABLE/All criteria met.
- II.    **Instrument Performance:** ACCEPTABLE/All criteria met.
- III.   **Calibration:** ACCEPTABLE/All criteria met.
- IV.    **Blank Analyses:** ACCEPTABLE/All criteria met.
- V.     **Surrogate Recovery:** ACCEPTABLE/With the following exceptions.  
  
          **Qualified Data:** None

Discussion

The surrogate recovery (410%) for the product sample was outside of QC limits (31-141%) due to matrix interferences. No qualifications of data are recommended.

- VI.    **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Sample Analyses:**  
      ACCEPTABLE/With the following exceptions.  
  
      **Qualified Data:** None

Discussion

The complexity of the matrix for this sample necessitated a 1:100 dilution. At this dilution all spiked compounds should have been diluted out. All percent recoveries of all spiked compounds were outside of QC limits (4-149%). Interferences in the matrix undoubtedly led to these problems and no qualifications of data are recommended.

- VII.   **Field Duplicates:** Not Submitted.

Discussion

A field duplicate was not submitted, but the laboratory performed the product sample

analysis in duplicate. The results of the duplicates were compared. The highest RPD value was 31.6%, which indicates an acceptable level of precision.

**VIII. Compound Identification: ACCEPTABLE/All criteria met.**

**IX. Compound Quantitation and Contract Required Quantitation Limits (CRQLs):  
ACCEPTABLE/All criteria met.**

**X. Overall Assessment of the Data**

The laboratory performed the PAH analysis within contract specifications. The data, as reported, are acceptable for use.

## DATA VALIDATION REPORT TOTAL METALS ANALYSES

### I. Sample Holding Times: ACCEPTABLE/With the following exceptions.

#### Discussion

The samples were all analyzed within the water recommended holding time, except samples S22813 and S22814 for mercury. The two samples were analyzed one to two days outside the recommended holding time for water. Because sample analysis only exceeded the water recommended holding time by 1 - 2 days, and no holding time criterion has been established for soils, no data qualifiers are recommended.

### II. Instrument Calibration: ACCEPTABLE/All criteria met.

#### Discussion

All Initial and Continuing Calibration Verification (ICV and CCV) standards used for sample determinations were within the control limits for all samples.

### III. Blanks: ACCEPTABLE/With the following exceptions.

#### Qualified Data:

Analyte	Qualifier	Sample Number	Reason
Aluminum	UJ	S20825, S20825D	Sample results within five times the blank concentration.
Barium	UJ	S20825	Sample results within five times the blank concentration.
Iron	UJ	S20825, S20825D	Sample results within five times the blank concentration.
Magnesium	UJ	S20825	Sample results within five times the blank concentration.
Potassium	UJ(-) J4(+)	S22813, S22814, S22815	Negative blank results reported. The possibility of false negative or biased low sample results exists.
Sodium	UJ	S20825	Sample results within five times the blank concentration.

Zinc	UJ	S20825, S20825D	Sample results within five times the blank concentration.
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#### Discussion

Two types of blanks were evaluated for possible contamination affects. These blanks are: calibration blanks (CCB) and preparation blanks (PB).

For all laboratory blanks, both positive and negative blank values are evaluated, and an action limit of five times the highest associated blank concentration is determined for each affected analyte. For analytes with positive blank values, if the sample result was less than the action limit, it should be considered undetected at the reported concentration and assigned a UJ qualifier. No data qualifiers are required for undetected sample results. For analytes with negative blank values, the raw data were reviewed, and each sample raw data result was checked to see if a possible false negative or biased sample result was reported. Samples to be qualified, based on this review, are summarized in the above table.

IV. ICP Interference Check Sample (ICS) Analysis: ACCEPTABLE/All criteria met.

V. Laboratory Control Sample (LCS) Analysis: ACCEPTABLE/With the following exceptions.

Qualified Data: None.

#### Discussion

The laboratory analyzed a soil standard as the LCS with the product sample. The matrices are not comparable. However, no standard is available that would match the product sample.

VI. Duplicate Sample Analysis: ACCEPTABLE/With the following exceptions.

Qualified Data: None.

#### Discussion

The duplicate results were within the control limits for all analytes. Chromium was flagged by the laboratory as being outside the control limits for JOB303. The relative percent difference (RPD) for chromium was 26.1%. The laboratory is required to flag any analytes with a RPD greater than 20%. Under the 1988 Inorganics Functional Guidelines,

soil sample duplicate results are acceptable if the RPD is less than 35% or results less than two times the CRDL. Therefore, no data qualifiers are recommended.

**VII. Spiked Sample Analysis: ACCEPTABLE/With the following exceptions.**

**Qualified Data:**

Analyte	Qualifier	Sample Number	Reason
Arsenic	UJ(-) J4(+)	S22813, S22814, S22815	The percent recovery of the MS was 66%.
Arsenic	R	S20825, S20825D	The percent recovery of the MS was 14%.
Lead	J4	S20825, S20825D	The percent recovery of the MS was 334%.
Lead	UJ(-) J4(+)	S22813, S22814, S22815	The percent recovery of the MS was 60%.
Selenium	J4	S20825	The percent recovery of the MS was 348%.
Selenium	UJ(-) J4(+)	S22813, S22814, S22815	The percent recovery of the MS was 73%.

**Discussion**

All matrix spike (MS) percent recoveries were within the control limits, except arsenic, lead, and selenium for both SDG. Sample qualifications were determined following the guidelines specified in the 1988 Inorganics Functional Guidelines. Samples to be qualified are summarized in the above table.

The laboratory analyzed additional QC samples with JOB048. The laboratory analyzed a blank spike and a blank spike duplicate. The RPD between the blank spikes was calculated and all analytes had a RPD less than 20%. The percent recovery for the blank spikes was not calculated and true values were not included in the data package. Duplicate instrument analysis was performed on the matrix spike. The RPD between MS duplicate analyses for all analytes ranged from 5.1 - 22.0%.

**VIII. Furnace AA Quality Control Analysis: ACCEPTABLE/With the following exceptions.**

### Qualified Data:

Analyte	Qualifier	Sample Number	Reason
Lead	UJ(-) J4(+)	S20825, S20825D	Analytical spikes were not performed.
Selenium	UJ(-) J4(+)	S20825, S20825D	Analytical spikes were not performed.
Thallium	UJ(-) J4(+)	S20825, S20825D	Analytical spikes were not performed.

### Discussion

The laboratory is required to perform an analytical spike on each analyte analyzed by graphite furnace (GFA). The percent recovery control limits of the analytical spike is 85 - 115%. If sample analytical spike recoveries fall outside the control limits, matrix interferences (positive or negative) may be present. If the sample result is less than 50% of the analytical spike concentration and the percent recovery is greater than 40%, no further action is required by the laboratory, but the laboratory must flag the data with a W. The laboratory correctly flagged all samples associated with JOB303. The laboratory did not analyze analytical spikes with JOB048. Arsenic was analyzed by methods of standard additions. Lead, selenium, and thallium were analyzed directly on the graphite furnace, requiring the analysis of an analytical spike. It is recommended that the sample associated with JOB048 be qualified for lead, selenium, and thallium because matrix interferences may be present.

If the sample absorbance is greater than 50% of the analytical spike concentration and the percent recovery is outside the control limits, the laboratory is required to analyze the sample by methods of standard additions (MSA). The laboratory did perform the MSA analyses where required. All samples analyzed by MSA had correlation coefficients within the control limits ( $>0.995$ ).

The 1988 Inorganic Functional Guidelines specifies that samples with analytical spike recoveries outside the control limits (85-115%) are to be qualified as estimates. However, review of the data indicated that no sample, where the post spike recovery was outside the control limits, had results detected above the CRDL. It is recommended that only those samples with analyte concentrations greater than the CRDL be qualified.

Samples Requiring the W Qualifier			
Arsenic	Lead	Selenium	Thallium
S22815	S22813 S22814	None	None

IX. ICP Serial Dilution Analysis: ACCEPTABLE/All criteria met.

X. Sample Result Verification: ACCEPTABLE/With the following exceptions.

Qualified Data: None.

#### Discussion

QC sample results and sample results were verified at a frequency of ten percent. No data calculation errors were found.

For Sample S22814, the laboratory did not list the N qualifier for arsenic. The laboratory was contacted and a corrected Form 1 was submitted.

XI. Field Quality Controls: Not Applicable.

XII. Quarterly Submissions: ACCEPTABLE/All criteria met.

#### XIII. Overall Assessment of Data

The overall quality of the data packages was good. Samples were qualified for blank contamination, and matrix spike results. The laboratory performed all required QC checks for both SDG. For JOB048, the laboratory analyzed additional QC checks (Blank spikes and analyzed the MS in duplicate). However, the matrix of the product sample submitted in JOB048 made analysis difficult, and all results for that sample suspect. Sample qualifications were made based solely on the results of the QC checks analyzed. It should be noted that the QC samples available to the laboratory may not reflect the problems associated with this sample due to the matrix interferences.